A. COVER PAGE

Project Title: Pacific Northwest Agricultural Safety and Health Center (PNASH) Yost - Planning and Evaluation	
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Change of Contact PD/PI: NA	
Human Subjects: NA for Planning and Evaluation. See project reports	**Vertebrate Animals:** No
hESC: No	**Inventions/Patents:** No

B. ACCOMPLISHMENTS

B.1. What are the major goals of the project?

Planning and Evaluation Core
AIM 1 Management, Operations, Facilities and Communications
AIM 2 Internal and External Advisory Committees
AIM 3 Data and Statistical Service
AIM 4 NIOSH and NIOSH Agricultural Center Collaboration
AIM 5 Pilot/Feasibility Program and Emerging Issues Fund
AIM 6 Evaluation Program

B.2. What did you accomplish under these goals?

PNASH's Planning & Evaluation Core (P&E Core) sets the direction, supported the operations, and facilitated evaluation across PNASH's individual projects and programs. All P&E Core activities were highly coordinated and integrated into the objectives of PNASH core programs, with the goal to meet high scientific standards, and collaborate with community and industry partners goals to move results to practice. Our 2016-2022 program cycle marked PNASH's 25th anniversary with successful transitions in leadership, significant growth in outreach and communications capacity, and continuing development of dairy, commercial fishing, and forestry research. This cycle highlights our long-standing community-academic partnerships with our rapid response to emerging hazards, such as COVID-19 and wildfire smoke. The P&E Core organizational structure operates in close coordination with the Outreach Core, Pilot Project Program, and projects' research and advisories.

AIM 1. Management, Operations, Facilities and Communications

The P&E Core provides the central support for all Center activities. Program operations include:
Institutional & Partner Relationships. The P&E Core establishes and maintains our relationships, collaborations and formal arrangements/agreements with nation and regional organizations. These include, for example in this proposal, our regional academic partners at Oregon State University, Washington State University, University of Idaho, and Bassett Research Institute. Our community partner arrangements are co-managed with the Outreach Core. We collaborate closely with the NIOSH Agriculture, Forestry, and Fishing (AgFF) Program and NIOSH Ag Centers through monthly Ag Center Director Meetings that are currently facilitated by PNASH. We also work with), NIOSH's NORA, the NIOSH Ag Center Evaluators, Coordinator and Outreach (ECO) Group, and the Association of University Programs for Occupational Health and Safety (AUPOHS).). PNASH and the other Ag Centers meet annually in conjunction with lead partners in the agricultural safety field or at NIOSH coordinated meetings. These key events include the International Society of Agricultural Safety and Health (ISASH) and Agricultural Safety and Health Council of America (ASHCA), each of which has occasional academic meetings to facilitate work with industry (ASHCA) and intramural investigators (NIOSH). Likewise, PNASH is active in other national collaborations, AgriSafe Network, Children's Agricultural Safety Network (CASN), and the Western States Occupational Network (WEST/ON). We recognize that collaboration in academia happens through the creation of space and platforms for our faculty, partners and students to come together to foster new ideas. We therefore support our investigators in their participation in the forum listed before, and also in other professional and scientific conferences, such as the successful Western Regional Conference on Agricultural Health and Safety, *Cultivating Collaborations,* held in Seattle in 2019.

Mentorship and Human Resources. Most important to PNASH's success are the approximately 90 affiliated faculty, staff, and students. A number of PNASH staff have served in the Center for more than 20 years and work in off-site locations based in the agricultural regions they serve. In conjunction with our research projects, PNASH offers academic and educational opportunities at undergraduate, graduate, post-doctoral and junior investigator levels. We directly support positions with funding, assist with grant development, and provide mentorship. Examples of PNASH's success as a foundation for learning can be seen in our list of students (See Overall section's Past Performance), and these extraordinary awards: Maria Blanca's Bullitt Foundation Award, Gabino Abarca and Magali Blanco with multiple awards, Dr. June Spector's NIOSH K01 award, and Catherine Karr's Presidential Early Career Award.

PNASH coordinates with multiple UW training and pathway programs for our staff, student, and faculty support and research funding to work with PNASH projects, such as: UW Professional Development, Department of Environmental and Occupational Health Sciences (DEOHS) Continuing Education Program, Undergraduate Research Experiences in Environmental Health (SURE-EH),); NIEHS training grants, NIOSH diversity grants, NIOSH's Education and Research Center (ERC),); UW College Assistance Migrant Program, and BEBTEH Trainees. Annually we organize internal workshops and trainings to address important areas for professional growth in a retreat setting (e.g., Vulnerable Populations Workshops, Research Translation Retreat). In addition, our **PNASH Student AgFF Research Interest Group** meets quarterly, bringing together PNASH faculty, students, and staff in a student-led and student-focused forum. The purpose of this group is to enhance collaboration and learning between PNASH faculty, staff, students, and others interested in AgFF research.

Grant Management and Development. Each year, thanks to the nucleus of research expertise and support formed by the PNASH Center, our faculty and staff researchers successfully procure additional project grants to help advance the goals and priorities of the PNASH Center. In the past 5-year cycle, our faculty were awarded 20 new research project awards affiliated with PNASH (not including PNASH internal awards or student scholarship and trainee awards). The P&E Core manages grant awards for our investigators in the areas of protocol assurance, and record keeping and reporting in compliance with institutional, state and sponsor requirements. Reporting for the NIOSH cooperative agreement takes place through a year-end report, progress report and renewal, final report, and periodic reports for external review. These reports are compiled through internal quarterly reporting and are coordinated with the Evaluation Program's *Harvest* database and monitoring activities. The *Harvest* database provides a common platform for collecting project information for evaluation and reporting, and also give the P&E core the ability to monitor progress over time and generate new reports or queries in response to evolving needs. The Core also establishes and monitors subcontracts and budgets, oversees purchasing, and reconciles budgets and project expenses as well as ensures fiscalall in accordance with fiscal policies and procedures fulfillthat comply federal and state audit requirements.

Resources and Facilities. The P&E Core is responsible for resources and infrastructure housed within PNASH, including systems and our field study and outreach supplies. This past cycle we have built capacity in the use of digital technologies and media to engage with our stakeholders, in English and Spanish. This transition became key during the pandemic, and is now extending to this cycle's proposal which includes social media engagement, webinars, Print & Ship online ordering system, SMS instant polling, digital resource repositories, electronic checklists, peer-to-peer workgroups, and interactive data dashboards which allow stakeholders to directly interact with researchers and explore data. Also during the COVID pandemic, we were able to effectively develop project-specific human subject safety protocols and return-to-work plans. Our communications and dissemination systems were also enhanced with a new direct order, 'Print and Ship' ordering system, an online storefront. Our P&E team also produced a new PNASH 'About Us' Video presenting our mission and showcasing our PNASH people and projects. See PNASH's video here. Events such as advisory meetings, workshops, conferences, and courses are supported through PNASH event coordination. The Center has a history of successful events and a capacity for supporting events of any scale. (Please see Facilities and Other Resources section for further details).

AIM 2 Internal and External Advisory Committees

The Internal Advisory Committee (IAC) met monthly, providing oversight and advice to the Principal Investigator and project investigators in making scientific and administrative decisions. Committee members include:

Michael Yost, PhD, Director, airion@uw.edu
Elena Austin, PhD, elautin@uw.edu
Richard Fenske, PhD, MPH, Associate Director, rfenske@uw.edu
Edward Kasner, PhD, Director of Engagement & Education, ejkasner@uw.edu
Laurel Kincl, PhD, Associate Professor,
Marcy Harrington, MPA ,Center Manager, marcyw@uw.edu
Catherine Karr, MD, PhD, Internal Advisory Committee, ckarr@uw.edu
June Spector, MD, Internal Advisory Committee, spectj@uw.edu

Key personnel changes this cycle included the appointment of Dr. Kasner as Outreach Director, and Dr. Austin as lead of the Pilot Project Program. The IAC also saw the addition of Dr. Laurel Kincl and Dr. Elena Austin.

PNASH Scientific Advisory Committee

PNASH's Scientific Advisory Committee (SAC) provided the Center and the projects with guidance on effectiveness, the direction of future work, project methods, and result interpretation as well as the relevance of activities to regional and national policies and initiatives. The SAC met bi-annually with one in-person meeting each year: This cycle, the SAC focused on data surveillance, TWH, mentorship, and new project directions.

PNASH's Scientific Advisory Committee (SAC) membership included:

Kent Anger, PhD, Professor and Director, OHSU and Portland State joint School of Public Health, Oregon Health Workforce Center

Howard Kipen, MD, MPH, Chair and Professor, Environmental & Occupational Medicine, Rutgers University

Linda McCauley, RN, PhD, FAAN, FAAOHN, Dean and Professor, Nell Hodgson Woodruff School of Nursing, Emory University

In 2020, Jennifer Lincoln, Ph.D., CSP, Director, NIOSH Center for Maritime Safety and Health Studies, stepped down from service as a member of PNASH's Scientific Advisory Committee.

AIM 3 Data and Statistical Service

The primary function of this service was statistical consultation. Paul Sampson and Tamre Cardoso, from UW Statistics, provided consultation to each project as needed, with an emphasis on student sub-projects. In addition, a PNASH service team will maintained consistency in data management and quality assurance across the center and consultative service to investigators in data security and access. Data Safety Management and Access Plans were completed for each project with significant data assets (see product listing under each project). PNASH ensures:

- Consultative service to investigators in data analysis and biostatistics
- Assistance with the development and implementation of data management plans
- Central archiving and access to archival data resources

AIM 4 NIOSH and NIOSH Agricultural Center Collaboration

PNASH staff and faculty collaborate with NIOSH and the ten other NIOSH-funded Agricultural Centers through regular Center Director meetings, the Agricultural Center Evaluation, Communication, and Outreach (ECO) group, and special events and workgroups. We recognize that collaboration in academia happens through the creation of space and platforms for our faculty and students to come together and foster new ideas. The PNASH Center was active through:

Coordinating Center for AFF Center Directors. PNASH served a two-year term as the coordinating center for the NIOSH AgFF Directors, with this term ending in July 2022. This group of 42 leaders of NIOSH AFF and Ag Centers coordinate on national issues and cross-center initiatives. Meetings took place monthly by video conferencing. In FY21-22 we wrote a NIOSH blog on the history of the Ag Center program, coordinated Ag Center legislative communications, and provided a forum for shared planning for the Center program renewal.

Association of University Programs in Occupational Health Sciences (AUPOHS). Dr. Michael Yost served a term as President of the Association of University Programs in Occupational Health & Safety (AUPOHS). This umbrella organization is representative of the membership of the National Education and Research Centers, Agricultural Safety and Health Centers, and the Total Worker Health Centers, sponsored by NIOSH. It serves to coordinate priorities and communications between these Center programs. AUPOHS meets remotely and in-person annually.

International Society for Agricultural Safety and Health (ISASH). PNASH participated and sponsored the June 2022 conference. ISASH is the key professional organization with active workgroups in our field, and is open to extension into forestry and fishing fields as well. Our participation includes attending meetings of Ag Center Evaluators, Coordinators, and Outreach groups, and the Children's Agricultural Safety and Health Network.

Agricultural Center Evaluation, Communication, and Outreach (ECO) group. The ECO group coordinates cross-center activities and public information sharing. We have developed common indicators for social media campaign evaluation; and served as a launching ground for COVID-19, mental health, and contribution analysis of multi-site projects.

Ag Injury News Clippings Database. Ms. Harrington serves on the project Steering Committee and PNASH is contributing member for northwest injury reporting. http://www.marshfieldresearch.org/nfmc/aginjurynews.

Ag Center Surveillance Working Group. PNASH investigators Drs. Bovbjerg and Kasner were active in this workgroup, whose purpose was planning future surveillance best practices. Erica Scott of the NEC Center organized this group.

AIM 5 Pilot/Feasibility Program and Emerging Issues Fund

Pilot/Feasibility Project Program (See component report under Pilot/Feasibility Project Program).

Emerging Issues Program. Through PNASH's Emerging Issues Fund we can take rapid action to address an emergent issue or cultivate a developing partnership. The Fund allocates up to $50,000 direct costs per year with awards as small as $2,000. In Year 2 we modified the criteria of the Fund to prioritize partnership building activities. Awards are available to active investigators within PNASH's Northwest network.

PNASH's Emerging Issues Fund prioritizes partnership building activities. The fund is used to address issues and priorities raised through project advisory committees, solicitation from Center stakeholder meetings, and input from ad hoc advisors. Activities should fall outside of the scope of currently funded PNASH work. Distinguishing criteria for this fund are:
- New effort to cultivate a developing partnership
- Address issues and priorities raised by stakeholders
- High impact opportunity in preventing injury and illness
- Immediacy/timeliness of the need
- Not a fit for other funding streams
- Opportunity to extend our research into practice

PNASH's Emerging Issues allocations for the 2016-2022 cycle:

Dennise Drury. Delivering ¡Basta! Sexual Harassment in Agriculture Training. In response to requests for training from WA and OR growers, the PNASH Center delivered ¡Basta! trainings. Our team conducted six trainings for: WA Grower's League, Washington Wine Industry Foundation, Kraemer's Nursery, and Superfresh Growers. Training 320 growers, supervisors, workers and human resource managers.

Tania Busch Isaksen. Knowledge transference effect on N95 mask fit, by communication medium. The frequency of wildfires is increasing in Washington state. This study provided evidence on the efficacy of N95 respirators and training, a need identified by a state-wide workshop of 95 participants and 35 stakeholder organizations. The study assessed training materials and lay-user implementation, demonstrating that with training, N95 respirators can provide adequate protection for the general public during wildfire smoke events.

Edward Kasner. Smoke Monitoring for Agricultural Safety and Health (SMASH) - funded in part by Pilot Project Program. This project helped to develop a wildfire decision aid tools driven by data collected from a high-density network of air quality monitoring sensors. During the 2020 wildfire season, smoke sensors were added to an existing network of weather stations in agriculturally productive regions to explore applications such as worker safety and health, crop protection, and plume tracking. This study provided proof-of-concept for air quality monitoring based on the AgWeatherNet platform.

June Spector. Addressing Health Disparities Faced by Rural Underserved Agricultural Communities. This project stemmed from concerns, such as with wildfire smoke, expressed by farmworker participants in our summer 2018 farmworker survey and by our farmworker community partners. This small project conducted focus group studies with farmworkers, including indigenous Mexican immigrants, using personal storytelling to engage and document on environmental and occupational health concerns.

Edward Kasner. COVID-19 Rapid Response. PNASH partnered with WA Department of Labor and Industries Multicultural Safety and Health Outreach Program to develop resources to develop COVID-19 resources for agricultural employers, workers, and supervisors. The goal was to communicate the WA State workplace requirements for agriculture in an accessible and visual format in English and Spanish. The team produced 6 social media card sets (90 cards total) and 7 fliers on the WA workplace requirements. Through Facebook alone, these reached 18,505 people in the first 3 months. See resources developed at PNASH's COVID-19 page.

Christopher Simpson. Respiratory Health and Indoor Air Quality in Washington's Cannabis Industry - funded in part by Pilot Project Program. This pilot measured airborne contaminants associated with indoor cannabis production and evaluated the association with airway inflammation and/or respiratory symptoms. This study demonstrated tasks with respiratory risks and potential practical solutions in the workplace.

Peter Rabinowitz. Next-Generation Sequencing of the Dairy Worker Microbiome. Developed a pilot data set of metagenomics sequences from existing DNA samples on subjects from our Healthy Dairy Project. An emerging technology known as shotgun sequencing or "next-generation sequencing" (NGS) allows for sequencing of whole bacterial genomes, providing greater detail on genes, gene functional potential, and taxonomic resolution down to the strain-level.

Pablo Palmandez. Fluorescent Tracer: Train-the-Trainer. This project provided agricultural managers and educators the tools and skills to deliver their own trainings using the Fluorescent Tracer (FT) technique. FT uses fluorescents to visually demonstrate pesticide contamination. The core of the curriculum is based on the Quick Demos section from the Fluorescent Tracer Manual: English and 59 Spanish evaluation surveys were completed. Based on the positive feedback on the 2019 workshops, the FT Workshop was offered in 2020.

Kit Galvin. Bilingual Pesticide Safety App. The App provides English and Spanish translations of pesticides label safety information. These funds supported the App pilot with tree fruit industry partners, integrated pesticide labels for their industry, in-time for the Spring 2018 pesticide season. This pilot led to further expansion and external grant awards to bring the service to scale for WA agriculture.

Chris Simpson. Cannabis Allergy in Occupationally Exposed Cannabis Workers and Recreational Users. This small project addressed a study design challenge from our previous study that it is difficult to distinguish whether the Cannabis sensitization we observed was due to occupational exposure versus recreational use of Cannabis. We measured airborne contaminants associated with indoor cannabis production and evaluated the association with airway inflammation and/or respiratory symptoms. This study demonstrated tasks with respiratory risks and potential practical solutions in the workplace.

Viktor Bovbjerg, AgFF surveillance development.
This feasibility project assisted in positioning surveillance as a core Center function, fully integrating surveillance activities with the other PNASH projects. Doing so will enable projects to make rapid use of surveillance information to support their activities, as well as focus surveillance activities on those metrics which are important to projects and stakeholders. Specific aims were to:
1. Support to PNASH new and current projects
2. Identification of stakeholder advisory group members
3. Establish MOUs with state- and national-level data holders and managers.
4. Integrating surveillance with PNASH engagement and dissemination.

John Flunker. Identifying Emerging Occupational Safety and Health Issues among Agriculture, Fishing, and Forestry Workers in the Pacific Northwest Region.
This work followed two themes: 1) summarize and communicate injury and fatality rates in the Pacific Northwest region; and 2) elucidate factors related to the risk of workers experiencing occupational illness and injury, specifically from heat and wildfire smoke exposures. For theme 1) we focused on summarizing publicly available worker numerator and denominator estimates for injuries and fatalities, highlighting gaps in information, and producing products to disseminate these data, such as a PNASH fatalities dashboard and a GitHub page, both for stakeholders and researchers to examine available data and occupational group summaries. For theme 2) we focused on factors related to the risk of occupational heat and wildfire smoke exposure, injury, and prevention among impacted outdoor workers. Specifically, we published two manuscripts on occupational heat exposure and illness, conducted field work measuring heat exposure, generated research relevant to the WA heat and wildfire smoke rulemaking process, developed methods for assessing wildfire smoke exposure among WA crop workers, and presented on heat and wildfire smoke exposure among crop workers at an international webinar.

Jennifer Otten. Review of Food Security and Agricultural Total Worker Health.
This project's purpose was to review food security as a component of Total Worker Health. We examined the literature to assess how food insecurity measures have been related to total worker health in the past in the following areas: (1) What is the relevance/importance of food insecurity for worker health? Who among the working population experiences food insecurity? How and to what extent is food insecurity a determinant of health, safety, and productivity? (2) In what ways does food insecurity aligns with the Total Worker Health framework? How and to what extent has Total Worker Health focused on food security to date? How does food security relate to currently identified TWH issues of importance? How could TWH be applied to address food security going forward? (3) How and to what extent has food security been addressed in the workplace? How have workplace/workforce interventions been designed to address food insecurity for workers to date? The literature review is complete, a manuscript has been fully drafted, next steps are to circulate the manuscript to a handful of TWH reviewers and then submit the manuscript for peer-review and publication.

Elena Austin. Stress and Anxiety in Latino Farmworkers - Modifiable Workplace Factors (StrAW).
This one-year project focused on the Latino farmworker - identifying workplace stressors contributing to mental health burden and develop a common language framework to enhance discussion of mental health, particularly between workers and employers. This project demonstrated there is a lack of resources for Spanish speakers and their mental health. End products include the development a new mental health questionnaire for Latino agricultural workers, key language and messages for this audience, and a website of resources. See Farmworker Stress and Anxiety Resources | Pacific Northwest Agricultural Safety and Health Center (washington.edu).

AIM 6 Evaluation Program
PNASH's evaluation program ensured our efforts are relevant, feasible, and sustainable; that they reflect the best science and workplace practices; and they are consistent with the ultimate goal of reducing exposure, injuries, and illness. Evaluation results were presented to Internal Advisory Committee and informed our strategic planning and shorter-term rapid-response activities.

Stakeholder Needs Assessments. To assess PNASH's responsiveness to regional needs and inform PNASH Center and project planning, three approaches were taken: routine interviewing of stakeholder advisories, special community needs assessments, and annual monitoring of Northwest Ag Health Indicators. Special assessments included:

- Yakima farmworker community occ. and environ. priorities, in conjunction with PNASH Research Review.
- Migrant and indigenous farmworker health and safety needs assessment – Skagit and Whatcom Counties, WA (Funded in part by UW Population Health and Bullitt Foundation awards).
- Logging safety stakeholder survey - interactive audience polling and Logging Safety Summit, OR
- Ag promotorx training and certification needs assessment.
- Farm training and resources needs (English and Spanish), in conjunction with annual Ag Safety Day. Focus areas have included: training format; childrens' farm safety, sexual harassment prevention
- PNASH COVID-19 Needs Assessments: With the onset of the COVID-19 pandemic, our focus turned to assess information needs and the experience of those in northwest farming, fishing, and forestry, including:
  AgFF stakeholder advisors and partners. In addition to COVID-19, open questions assessed current climat needs from PNASH, and their future priorities and initiatives.
  Farmworker phone interviews (in partnership with COVID Farmworkers Study in CA, OR and WA)
  Extension professionals online survey (in partnership with Southern Coastal Ag Center)
  Dairy management phone interviews (with Dairy project)

Ag Health Indicators. Our Ag Health Indicators program conducted regular surveillance activities, while also building new data repositories and visualization systems. Ag Health Indicators successfully expanded from its PNASH Center Evaluation home into new projects led by Dr. Elena Austin:

- Kincl. Safety Surveillance for Pacific Northwest Fisheries
- Austin. Pilot: An Agricultural Worker Data Repository and Interactive Visualization
- Austin. Pilot: Nitrate Well Water Testing in Agricultural Communities

Drs. Austin and Kasner mentored our faculty and students in data indicators and visualizations and hosted internal data workshops, *Estimating Burden: Agricultural Health Indicators & Data Visualization*, for our investigators and student researchers. The workshop introduced:

1. The utility of R and R-Studio for data analysis and visualization, including engagement with partners and stakeholders with this data, and
2. Our newly compiled morbidity, mortality, and demographic data sources on a GitHub shared platform.

We found there was an interest in regular investigator training and Open Data Kit systems. Our overarching PNASH goal is to modernize our data management system to support
replication and transparency.

Performance, Developmental, and Outcome Evaluation.
PNASH's evaluation program moves beyond traditional program monitoring, using a developmental approach to assist project teams in improving efficacy and outcomes. PNASH's 2016-2022 evaluation accomplishments include an update to our program and outcome monitoring tools: PNASH's custom 'HARVEST" database for PI reporting; Logic Model Template, Outcomes Table, and PNASH Evaluation Guide. This suite of tools was completed to harmonize with the new objectives and tools drafted by NIOSH in Burden, Need, and Impact and Contribution Analysis.

Biannually, PNASH internally assessed progress and impacts. We used a logic model framework in project and program evaluation plans (See Appendix D: PNASH Logic Model and Outcomes Table). PNASH methods drew on the stakeholder and data-based needs assessments described above, developing innovative surveys, interviews, and participatory research methods. This complexity required close collaboration and review with our stakeholders and scientific advisors to ensure their feasibility and relevance.

Dr. Brock and Ms. Harrington, in coordination with the Outreach Core, conducted mid-cycle developmental evaluation consultations with project teams, evaluating: successes; unanticipated challenges; plans for navigating challenges; current and future project impacts; and, how stakeholders can become more positively engaged. In

these sessions, PNASH project teams revisited their outcome metrics table to outline a specific approach for outcome and impact evaluation. Our outcomes table was modified this cycle to align with NIOSH contribution analysis table categories.

In these sessions, we specifically assessed impact opportunities, which are areas where there is an emerging trend and a target audience for a health or safety intervention shows interest and acceptance in the intervention. Identifying these areas and determining appropriate intermediate impact metrics is a step toward an action plan to move an intervention into practice.

Our program monitoring database, "Harvest**,"** was customized to our NIOSH and Ag Center evaluation goals, allowing tracking and analysis of PNASH project outcomes and impacts. Unique to this database is the integration of impact stories, stakeholder anecdotes/quotes, PHS Progress Report fields, and a customizable evaluation matrix to track project-specific indicators of success, such as those reported in this final report. The system employs a relational database with a web-hosted platform for any-time, any-where data entry and reference. Unique to this database is the integration of impact stories, stakeholder those reported in this final report. Two Agricultural Centers, the National Children's Center, and the UC Davis Center, have adopted and developed the database for their use.

NIOSH AgFF Initiative and Multi-Site Evaluation.
PNASH collaborates regularly with NIOSH and the ten Ag Centers in evaluation through:

Agricultural Center Evaluation, Communication, and Outreach (ECO) group. The ECO group shared evaluation methods. We have developed common indicators for social media campaign evaluation, and served as a launching ground for COVID-19, mental health, and contribution analysis multi-site projects.

Ag Injury News Clippings Database, http://www.marshfieldresearch.org/nfmc/aginjurynews**.** Served as contributing member and Ms. Harrington on the project Steering Committee.

Ag Center Surveillance Working Group. PNASH investigators Drs. Bovbjerg and Kasner were active in this workgroup, planning future surveillance best practices, organized by Erica Scott of the NEC Center.

Contribution Analysis Capacity Building & Pilot of Heat-related Illness Multi-site Analysis. PNASH joined NIOSH evaluators and a multi-center evaluation team in contribution analysis, with Ms. Harrington served as Chair of the pilot on Heat-related Illness research and education. Our resulting analysis, including the logic model and evidence table, was used by NIOSH Evaluators as examples in their training and to inform NIOSH's development of future guidance and common tools.

B.3. Competitive Revisions/Administrative Supplements

In Year 5, PNASH received an administrative supplement of $31,404 (20,326 DC and 11,078 IDC) to our Emerging Issues Program. Subsequently, an award was granted from these funds to Dr. Elena Austin for the project: Mental Health Stressors Impacting PNW Spanish Speaking Agricultural Workers. This project will build capacity with support programs at Washington State University and the Northwest Communities Education Center. This one-year project aims to identify workplace stressors contributing to mental health burden and develop a common language framework to enhance discussion of mental health particularly between workers and employers. End products will include the development prototypic story-based descriptions of mental health stress and anxiety in farmworkers and identify sources of trusted information to initiate change**.**

The Year 6 extension, 2021-2022, was supported through an administrative supplement to PNASH.

B.4. What opportunities for training and professional development did the project provide?

UW PNASH Center supports professional development of our faculty, staff and students. We offer training through our UW Professional Development Office, Northwest Occupational Safety and Health Center (ERC), and the professional associations that our personnel participate in (eg, ISASH, AIHA, ISES).

We continue to build a pipeline of agricultural safety and health excellence in the Northwest by providing our members with the tools, guidance, and support to thrive in their careers. At the undergraduate level, we will continue to host students through the UW-DEOHS Supporting Undergraduate Research Experiences in Environmental Health (SURE-EH) Program, the UW-Bothell Community-Based Learning and Research (CBLR) Fieldwork Program, and the UW College Assistance Migrant Program (CAMP) Program. At the graduate level, we will continue to support students through the PNASH pilot program, the Northwest Center for Occupational Health and Safety ERC trainee program, quarterly meetups of the student-led Agriculture, Forestry, and Fishing Research Interest Group (AgFF

RIG), and the UW Population Health Initiative pilot research grants. We support Research Supplements to Promote Diversity in Health-Related Research (i.e., Diversity Supplements) for trainees with the Center.

PNASH staff members will continue to have professional development and skill-building opportunities. The UW Human Resources program offers a Professional and Organizational Development program that allows adult learners to quickly build knowledge, skills, and abilities in areas of their own interest. The course catalogue has sessions focused on communications, diversity and inclusion, fiscal procedures and management, personal and professional growth, planning and productivity, human resources, and supervision and leadership.
A unique opportunity our group participated in was the workshop, A Community Based Approach to Anti-Racism Training and Engagement. This workshop is one in a 2 part series. This first training focus: History of Race and Racism in Public Health; Social Determinants of Health and Health Disparities.

Additional support and training was also offered this last year through our UW CareLink: the employee assistance program hosted a webinar series to promote personal wellness and productivity. Topics include managing staff through stressful situations, "Let's talk politics": how to disagree without damaging relationships, being adaptive in an everchanging world, work-life balance in a work from home environment, and mental health awareness for leaders.

At the faculty level, PNASH early-career researchers will continue to be paired with senior mentors and be encouraged to pursue internal and external competitive grant funding opportunities in the AgFF sector.

B.5. How did you disseminate the results to communities of interest?

The Planning and Evaluation Core supports dissemination activities through the management of events and communications systems, and through our evaluation (in conjunction with project teams) to assess and communicate regional needs and our project impacts. Our Outreach and Education Core directly supports research translation and dissemination - please see the reporting section for the Outreach and Education Core.

B.6 - What do you plan to do during the next reporting period to accomplish the goals?

This program cycle has closed. Under PNASH new 2022-2027 cycle, the 'Evaluation and Planning Core' will complete any final evaluation and reporting objectives, these are primarily supporting the assessment of user/audience experience and understanding of our work in returning results to communities and industries.

C. PRODUCTS

C.1. Publications, conference papers, and presentations

Blancas M. Re-storying Food System Assessments: A Community-Based Approach to Assess Food System Impacts on Farmworkers. 2022 Doctoral Dissertation. Department of Environmental and Occupational Health Sciences, University of Washington, Seattle, Washington. See Abstract. ResearchWorks.

D'Evelyn SM, Jung J, Alvarado E, Baumgartner J, Caligiuri P, Hagmann RK, Henderson SB, Hessburg PF, Hopkins S, Kasner EJ, Krawchuk MA, Krenz JE, Lydersen JM, Marlier ME, Masuda YJ, Metlen K, Mittelstaedt G, Prichard SJ, Schollaert CL, Smith EB, Stevens JT, Tessum CW, Reeb-Whitaker C, Wilkins JL, Wolff NH, Wood LM, Haugo RD, Spector JT. Wildfire, Smoke Exposure, Human Health, and Environmental Justice Need to be Integrated into Forest Restoration and Management. Current Environmental Health Reports. 2022 Sep;9(3):366-385. doi: 10.1007/s40572-022-00355-7. Epub 2022 May 7. PMID: 35524066; PMCID: PMC9076366.

Fenske RA, Pinkerton KE. Climate Change and the Amplification of Agricultural Worker Health Risks. Journal of Agromedicine. 2021 Jan;26(1):15-17. doi: 10.1080/1059924X.2021.1849211. Epub 2021 Jan 25. PMID: 33487144. **PMCID Pending**

Galvin K, Kasner E, Cruz I, Palmández P. Bridging Safety Language Disparities in Orchards: A Pesticide Label Mobile App. Journal of Agromedicine. 2021 Jan;26(1):6-14. doi: 10.1080/1059924X.2020.1795035. Epub 2020 Aug 1. PMID: 32744172. **PMCID Pending**

Harrington MJ. Forestry - Integrating Safety in a Time of Rapid Change. Journal of Agromedicine. 2021 Jan;26(1):88-91. doi: 10.1080/1059924X.2021.1849294. Epub 2021 Apr 11. PMID: 33843488. **PMCID Pending**

Keifer M, Sammen J, Hoare L, Harrington M. At Work in the Woods: Occupational Hazards of Harvesting Non-Timber Forest Products in the Pacific Northwest. Journal of Agromedicine. 2019 Apr;24(2):125-128. doi: 10.1080/1059924X.2019.1578140. Epub 2019 Mar 6. PMID: 30720391. **PMCID Pending**

Kuras ER, Richardson MB, Calkins MM, Ebi KL, Hess JJ, Kintziger KW, Jagger MA, Middel A, Scott AA, Spector JT, Uejio CK, Vanos JK, Zaitchik BF, Gohlke JM, Hondula DM. Opportunities and Challenges for Personal Heat

Exposure Research. Environmental Health Perspectives. 2017 Aug 1;125(8):085001. doi: 10.1289/EHP556. PMID: 28796630; PMCID: PMC5783663.
Lincoln JM, Carruth A, Cherry D, Kincl L, Syron LN. Occupational Health Research in the Commercial Fishing Industry. Journal of Agromedicine. 2021 Jan;26(1):28-30. doi: 10.1080/1059924X.2021.1849494. Epub 2021 Jan 25. PMID: 33487133. **PMCID Pending**
Prado JB, Mulay PR, Kasner EJ, Bojes HK, Calvert GM. Acute Pesticide-Related Illness Among Farmworkers: Barriers to Reporting to Public Health Authorities. Journal of Agromedicine. 2017;22(4):395-405. doi: 10.1080/1059924X.2017.1353936. PMID: 28762882; PMCID: PMC5846675.
Sheppard L, McGrew S, Fenske RA. Flawed Analysis of an Intentional Human Dosing Study and Its Impact on Chlorpyrifos Risk Assessments. Environment International. 2020 Oct;143:105905. doi: 10.1016/j.envint.2020.105905. Epub 2020 Jul 3. PMID: 32629200. **PMCID Pending**
Spector JT, Masuda YJ, Wolff NH, Calkins M, Seixas N. Heat Exposure and Occupational Injuries: Review of the Literature and Implications. Current Environmental Health Reports. 2019 Dec;6(4):286-296. doi: 10.1007/s40572-019-00250-8. PMID: 31520291; PMCID: PMC6923532.
Tigchelaar M, Battisti DS, Spector JT. Work Adaptations Insufficient to Address Growing Heat Risk for U.S. Agricultural Workers. Environmental Research Letters. 2020 Sep;15(9):094035. doi: 10.1088/1748-9326/ab86f4. Epub 2020 Aug 25. PMID: 33133229; PMCID: PMC7594196.

Publications from closed and past cycle NIOSH funded PNASH projects

Blanco MN. Real-time Particle Monitoring of Pesticide Drift from Two Different Orchard Sprayers. 2017 Master's Thesis. Department of Environmental and Occupational Health Sciences, University of Washington, Seattle, Washington. See Abstract. ResearchWorks.
Blanco MN, Fenske RA, Kasner EJ, Yost MG, Seto E, Austin E. Real-Time Monitoring of Spray Drift from Three Different Orchard Sprayers. Chemosphere. 2019 May, 222:46-55. doi: 10.1016/j.chemosphere.2019.01.092. Epub 2019 Jan 21. PMID: 30690400; PMCID: PMC6472945.
Blanco MN, Fenske RA, Kasner EJ, Yost MG, Seto E, Austin E. Real-time Particle Monitoring of Pesticide Drift from an Axial Fan Airblast Orchard Sprayer. Journal of Exposure Science and Environmental Epidemiology. 2019 Apr;29(3):397-405. doi: 10.1038/s41370-018-0090-5. Epub 2018 Nov 13. PMID: 30425317; PMCID: PMC6469994.
de Castro AB, Wilmsen C, Post S, Harrington MJ, Bush D. Worker versus Employer Perspectives on Safety in the Forestry Services Industry. Journal of Agromedicine. 2022 Jun 15:1-6. doi: 10.1080/1059924X.2022.2089422. Epub ahead of print. PMID: 35695387. **PMCID Pending**
Kasner EJ, Fenske RA, Hoheisel GA, Galvin K, Blanco MN, Seto EYW, Yost MG. Spray Drift from Three Airblast Sprayer Technologies in a Modern Orchard Work Environment. Annals of Work Exposures and Health. 2020 Jan 1;64(1):25-37. doi: 10.1093/annweh/wxz080. PMID: 31786605; PMCID: PMC7175243.
Kasner EJ, Fenske RA, Hoheisel GA, Galvin K, Blanco MN, Seto EYW, Yost MG. Spray Drift from a Conventional Axial Fan Airblast Sprayer in a Modern Orchard Work Environment. Annals of Work Exposures and Health. 2018 Nov 12;62(9):1134-1146. doi: 10.1093/annweh/wxy082. PMID: 30346469; PMCID: PMC7104543.
Lehrer N, Sneegas G. Beyond Polarization: Using Q Methodology to Explore Stakeholders' Views on Pesticide Use, and Related Risks for Agricultural Workers, in Washington State's Tree Fruit Industry. Agriculture and Human Values. 2018 Jan;35(1):131-147. doi: 10.1007/s10460-017-9810-z. Epub 2017 Jun 30. PMID: 29643573; PMCID: PMC5890807.
Pouzou JG, Cullen AC, Yost MG, Kissel JC, Fenske RA. Comparative Probabilistic Assessment of Occupational Pesticide Exposures Based on Regulatory Assessments. Risk Analysis. 2018 Jun;38(6):1223-1238. doi: 10.1111/risa.12936. Epub 2017 Nov 6. PMID: 29105804; PMCID: PMC5936674.
Pouzou JG, Kissel J, Yost MG, Fenske RA, Cullen AC. Use of Benchmark Dose Models in Risk Assessment for Occupational Handlers of Eight Pesticides Used in Pome Fruit Production. Regulatory Toxicology and Pharmacology. 2020
Quiller G, Krenz J, Ebi K, Hess JJ, Fenske RA, Sampson PD, Pan M, Spector JT. Heat Exposure and Productivity in Orchards: Implications for Climate Change Research. Archives of Environmental & Occupational Health. 2017 Nov 2;72(6):313-316. doi: 10.1080/19338244.2017.1288077. Epub 2017 Jan 31. PMID: 28139172; PMCID: PMC5562533.
Quiller G. Heat Stress, Heat Strain, and Productivity in Washington State Tree Fruit Harvesters. 2017 Master's Thesis. Department of Environmental and Occupational Health Sciences, University of Washington, Seattle, Washington. ResearchWorks.
Spector JT, Krenz J, Calkins M, Ryan D, Carmona J, Pan M, Zemke A, Sampson PD. Associations between Heat Exposure, Vigilance, and Balance Performance in Summer Tree Fruit Harvesters. Applied Ergonomics. 2018 Feb;67:1-8. doi: 10.1016/j.apergo.2017.09.002. Epub 2017 Sep 15. PMID: 29122180; PMCID: PMC5912891.

Thamsuwan O, Galvin K, Tchong-French M, Aulck L, Boyle LN, Ching RP, McQuade KJ, Johnson PW. Comparisons of Physical Exposure Between Workers Harvesting Apples on Mobile Orchard Platforms and Ladders, Part 1: Back and Upper Arm postures. Applied Ergonomics. 2020 Nov, 89:103193. doi: 10.1016/j.apergo.2020.103193. Epub 2020 Aug 6. PMID: 32771690. **PMCID Pending**

Thamsuwan O, Galvin K, Tchong-French M, Aulck L, Boyle LN, Ching RP, McQuade KJ, Johnson PW. Comparisons of Physical Exposure Between Workers Harvesting Apples on Mobile Orchard Platforms and Ladders, Part 2: Repetitive Upper Arm Motions. Applied Ergonomics. 2020 Nov, 89:103192. doi: 10.1016/j.apergo.2020.103192. Epub 2020 Jul 29. PMID: 32738460. **PMCID Pending**

Wilmsen C, Castro AB, Bush D, Harrington MJ. System Failure: Work Organization and Injury Outcomes among Latino Forest Workers. Journal of Agromedicine. 2019 Apr;24(2):186-196. doi: 10.1080/1059924X.2019.1567421. Epub 2019 Feb 8. PMID: 30734660; PMCID: PMC6476664.

C.2. Website(s) or other Internet site(s) – include URL(s)

https://deohs.washington.edu/pnash/

C.3. Technologies or techniques

NA

C.4. Inventions, patent applications, and/or licenses

NA

C.5. Other products and resource sharing

Video: Pacific Northwest Agricultural Safety and Health Center, March 2021, https://www.youtube.com/watch?v=97fq4rOM5oE

PNASH Year-end Reports, https://deohs.washington.edu/pnash/index.php/reports-archive
30 Years of the NIOSH Agriculture, Forestry and Fishing Program | Blogs | CDC, https://blogs.cdc.gov/niosh-science-blog/2021/12/08/agff/

Evaluation Tool: Harvest Program Monitoring Database, v. 3.0

Evaluation Tool: Training Guide: PNASH Investigator Evaluation Guide, Jan 2021

Repository for PNW Agricultural Health Indicator Program: Data sources and analysis code

D. PARTICIPANTS

D.1. What individuals have worked on the project? Please include calendar, academic, and summer months.

airion	x	Michael Yost	MS, PhD	Center Director	10.8					NA
elenaaustin	x	Elena Austin	PhD	Assistant Professor	3.6					NA
dbrock	x	Doug Brock	PhD	Evaluation Co-Lead	3.6					NA
rfenske	x	Richard Fenske	MPH, PhD	Assoc. Director	3.6					NA
kitgalvin	x	Kit Galvin	MS, CIH	Research Scientist	3.6					NA
mjharrington	x	Marcy Harrington	MPA	Manager	54					NA
ckarr	x	Catherine Karr	PhD	Assistant Professor	1.6					NA
ejkasner	x	Edward Kasner	PhD	Assistant Professor	3.6					NA
		Ilsa Olsen	BA	Program Coordinator	18					NA
		Dennise Drury	BS	Program Coordinator	18					NA
		Jose Carmona	BS	Program Coordinator	6					NA
pdsampson	x	Paul Sampson	PhD	Professor	3.6					NA
spectj	x	June Spector	PhD	Assoc. Professor	3.6					NA
Lkincl	X	Laurel Kincl	PhD	Assoc. Professor		.27	.09			NA

D.2 Personnel updates

a. Level of Effort: NA

b. New Senior/Key Personnel: NA

c. Changes in Other Support: NA

d. New Other Significant Contributors: NA

E. IMPACT

E.1 - What is the impact on the development of human resources, if applicable?

The PNASH Center overall substantially contributes to the resource development to support industry and community partner initiatives.

UW PNASH Center supports professional development and mentoring of our faculty, staff, and students. We offer training through our UW Professional Development Office, Northwest Occupational Safety and Health Center (ERC), and the professional associations that our personnel participate in (e.g., ISASH, AIHA, ISES). Staff are encouraged to pursue specialized training and benefit from tuition exemption from the University of Washington.

E.2 - What is the impact the Public Health Relevance and Impact? The investigator should address how the findings of the project relate beyond the immediate study to improved practices, prevention or intervention techniques, legislation, policy, or use of technology in public health.
NA (See Project Reports)

F. CHANGES

F.1 – Changes in approach and reasons for change, including changes that have a significant impact on expenditures

Over 2020-2021 COVID-19 restrictions to in-person activities did result in less travel and field supply expenditures. These cost savings were generally offset by increases in staff effort to reorganize project plans, protocols, and facilitate remote engagement options.

F.2 - Actual or anticipated challenges or delays and actions or plans to resolve them

There were no delays.

F.3 - Significant changes to human subjects, vertebrate animals, biohazards, and/or select agents

There were no significant changes to our human subjects engagement, although methods were modified to remote options for COVID-19 safety considerations. Only one project resumed human subjects in-person activity this February 2021 with a revised human subjects protocol for COVID-19 safety, but participant study design was not impacted (see Rabinowitz- Healthy Dairy). Other projects completed activities or were able to pivot to remote engagement without significant changes.

G. Special Reporting Requirements

G.1 Special Notice of Award Terms and Funding Opportunities Announcement Reporting Requirements
NA

G.2 Responsible Conduct of Research
NA

G.3 Mentor's Research Report or Sponsor Comments
NA

G.4 Human Subjects

G.4.a Does the project involve human subjects?
No

G.4.b Inclusion Enrollment Data
NA

G.4.c ClinicalTrials.gov

Does this project include one or more applicable clinical trials that must be registered in ClinicalTrials.gov under FDAAA?

G.5 Human Subject Education Requirement

Are there personnel on this project who are newly involved in the design or conduct of human subject's research?
NA

G.6 Human Embryonic Stem Cells (HESCS)

Does this project involve human embryonic stem cells (only hESC lines listed as approved in the NIH Registry may be used in NIH funded research)?
NA

G.7 Vertebrate Animals

Does this project involve vertebrate animals?
NA

G.8 Project/Performance Sites

University of Washington, Seattle, WA

G.9 Foreign Component
NA

G.10 Estimated Unobligated Balance

G.10.a Is it anticipated that an estimated unobligated balance (including prior year carryover) will be greater than 25% of the current year's total approved budget?
No. There is an unobligated balance that is less than 25%. We understand this will be carried forward into our next award cycle.

G.11 Program Income

Is program income anticipated during the next budget period?
NA

G.12 F&A Costs

Is there a change in performance sites that will affect F&A costs?
No

I. OUTCOMES

I. Provide a concise summary of the outcomes or findings of the award, written for the general public in clear and comprehensible language, without including any proprietary, confidential information or trade secrets

Note: project outcome information will be made public in NIH RePORTER

Pacific Northwest Agricultural Safety and Health Center
Planning and Evaluation Core
https://deohs.washington.edu/pnash

Our Mission - The Pacific Northwest Agricultural Safety and Health Center conducts research and promotes best safety and health practices for Northwest producers, workers, and communities in farming, fishing, and forestry

Our Vision - Research for healthy workers, strong communities & productive agriculture

The PNASH's 2016-2022 funding cycle marks our 25th anniversary and a research portfolio only possible through a strong foundation of partnerships among our Northwest AgFF industries and communities. Our 6 core projects were:

- Edward Kasner. Prevention of Occupational Exposure to Pesticide Drift
- Peter Rabinowitz. The Healthy Dairy Worker Study
- June Spector. A Multi-Level Approach to Heat Related Illness Prevention in Agricultural Workers
- Michael Yost. Injury and Illness Prevention in the Pacific Northwest for the Dairy Industry
- Laurel Kincl. Safety Surveillance for Pacific Northwest Fisheries
- Kit Galvin. Practical Solutions for Pesticide Safety

The PNASH Center's internal network of investigators is comprised of over **90** faculty, staff, and students from multiple disciplines and institutions, including **48** student degree projects and internships. Each year this nucleus of PNASH's research expertise allows our faculty and students to successfully procure additional project grants and advance our center, and stakeholders, goals and priorities. In the past cycle, our faculty was awarded **20** new research project awards affiliated with PNASH (not including student scholarship and trainee awards). In addition, PNASH supported early career investigators around the Northwest (ID, Oregon, WA, AK) through **14** Pilot Project projects.

PNASH's Planning and Evaluation Core provides the infrastructure and support for the entire Center, conducts strategic planning, and assists in the implementation and evaluation of individual project and program objectives. Our cycle closed September 2022, completing a 6-year cycle of research activities and engagement across all three AgFF industries. We also successfully competed with a new portfolio of project proposals for our next 5-year program cycle. Read New federal grant to improve Northwest agricultural safety and health, https://deohs.washington.edu/pnash/blog/new-federal-grant-improve-northwest-agricultural-safety-and-health.

Resources

- VIDEO: About PNASH, https://youtu.be/97fq4rOM5oE
- PNASH Year-end Reports, https://deohs.washington.edu/pnash/index.php/reports-archive
- 30 Years of the NIOSH Agriculture, Forestry and Fishing Program | Blogs | CDC, https://blogs.cdc.gov/niosh-science-blog/2021/12/08/agff/
- Evaluation Tool: Harvest Program Monitoring Database, v. 3.0 (available on request)
- Repository for PNW Agricultural Health Indicator Program: Data sources and analysis code (available on request)

A. COVER PAGE

Project Title: Kasner – Outreach Core	
Grant Number: 5U54OH007544	**Project/Grant Period**: 09/30/2016 – 09/29/2022
Reporting Period: 09/30/2016 – 09/29/2022	**Date Submitted**: 12/28/2022
Program Director/ Principal Investigator 2016–2019 VANESSA GALVIZ, PHD Email: vanesg@uw.edu 2019-2022 EDWARD KASNER, PHD, MPH Phone number: 206 616-4225 Email: ejkasner@uw.edu	**Administrative Official Information** CAROL RHODES University of Washington Office of Sponsored Programs 4333 Brooklyn Ave NE SEATTLE, WA 98105 Phone number: 206-543-4043 Email: osp@uw.edu
Change of Contact PD/PI: NA	
Human Subjects: NA	**Vertebrate Animals:** No
hESC: No	**Inventions/Patents:** No

B. ACCOMPLISHMENTS

B.1. What are the major goals of the project?

Outreach and Education Core
AIM 1 Collaborate with stakeholders to identify the key issues and problems in agriculture that our Center can address by further research, intervention or educational activities
AIM 2 Develop a research-to-practice plan for each of the Center's projects to ensure that the benefits of our research, interventions and education are put back into the hands of agriculture workers and producers, health and safety professionals, health care providers, public agencies and academic institutions
AIM 3 Implement outreach strategies that are specific to the needs and communication preferences of each stakeholder group
AIM 4 Provide regular communications between the Center and the agricultural community and serve as a forum for our stakeholders to discuss issues and resolve emerging problems

B.2. What did you accomplish under these goals?

Outreach Core Organization
The Outreach Core provides the infrastructure to help the Center build relationships, identify stakeholder needs, and promote our programs, research findings, and resources with agricultural communities. Each PNASH project has at least one person who sits on the Outreach Core as a paid or volunteer member. This structure helps with cross-center coordination and builds on existing knowledge and skills. There are 12 members who actively participate in the Outreach Core, which meets monthly and also is organized in the following working committees:
Translation & Dissemination Committee supports research teams in promoting and sharing research findings and products with stakeholders. The committee will be helping to build relationships with stakeholders who can adopt the resource directly or disseminate the resources to agricultural workers and employers. It ensures Center content is linguistically, culturally, and technically appropriate. It sets guidelines for content and format, shares best practices, reviews material in development and before release, and develops a language glossary.
Communications Committee serves as the information bridge between stakeholders and the Center. It promotes products and events, reviews and updates the website, creates blog and e-news content, leads social media efforts, identifies channels and partners, and supports regional and national agriculture, forestry, and fishing campaigns. This committee also produces infographics and videos for Center projects. It formalizes the process for internal vs. external development, consults during production, sets a graphics repository, and creates products (data visualizations, graphics, photo novelas, video, or other design).
Needs Assessment Committee leads the engagement in regional advisories with agricultural workers and employers, community organizations, academics, and agencies. It identifies the assets and priorities of our partners organizations, responds to emerging issues, and evaluation our Center's engagement process and impact to ensure our reach is appropriate to the needs and equitable across stakeholder groups and our service region.

Aim 1. Collaborate with our stakeholders to identify the key issues and problems in agriculture that our Center can address by further research, intervention, or educational activities.

Outreach Mini-Grant Program
This small grant-making program was established in 2020 to provide a new funding opportunity to build new partnerships and expand the reach of PNASH resources among underserved communities. The opportunity was extended to community-based organizations, employers, cooperative extension agents, commodity groups, and health and safety educators. In Year 6, two applicants were funded in the amount of $7,500 each:

- *Wildfire Smoke Safety, Harvust Inc.* Harvust provides a mobile app and platform to help employers communicate and share resources with farmworkers. They received a mini-grant to promote wildfire safety resources their Air Quality Communication (AQC) tool which shares local air quality data and wildfire resources with workers (including PNASH Wildfire Safety resources), and 2) acquiring data to improve the air quality information shared through for farmworkers provided by their AQC tool. As of July 2022, Harvust has disseminated wildfire resources with 6,342 farmworkers during 416 safety meetings on 67 farms in Washington State.
- *Pesticide Safety in the Cannabis Industry, Cannabis Allliance* The Cannabis Alliance is an organization which seeks to improve the business environment for the cannabis industry through education and advocacy. They were funded to develop the Cannabis Alliance Pest Management Workshop in WA for pesticide applicators with safety tips from the PNASH Practical Solutions for Pesticide Safety. The

workshop provided guidance on pesticide mixing and decontamination techniques tailored to the cannabis industry. In addition, they disseminated PNASH resources for cannabis safety with UV and practical solutions for pesticide warning signs, work-to-home exposure, mixing, hose reels, respirators, and glove racks.

Outreach Supplements to PNASH Pilot Project Program and ERC PTOP grants
PNASH Pilot Project Program's Outreach Supplement grants provides an additional funding opportunity of up to $5,000 for new pilot projects seeking to develop and disseminate new project results through community partnerships. Supplements were provided with Outreach Core collaboration for:

- *CLEAN AIR – I CARE: Stressors of balancing childcare, work, and concern of wildfire smoke exposures for farmworker parents*. PNASH PILOT to Savannah D'Evelyn, UW.
- *Pesticide exposures & risk perceptions among male & female Idaho Latinx farmworker.* PNASH PILOT to Carly Hyland, BSU.
- *Improving commercial fishing safety in Norton Sound: Knowledge from Alaska Native Salmon Set Gillnetters*. PNASH Pilot to Leann Fay, AMSEA.
- *Evaluating work-associated injuries among self-employed and wage-salaried agriculture, forestry, and fishing workers to identify injury burden and prevention opportunities*. ERC PTOP to Solaiman Doza, OSU.
- *Employer Perspectives on Wildfire Smoke Hazards in the Agricultural Workplace*. ERC PTOP to Molly Parker, UW
- *Examination of Glyphosate Exposure Among Latinx Farmworkers in Idaho.* ERC PTOP to Carly Hayland, BSU.
- *Measuring Safety and Health Risks at Yakima Valley Packing Houses.* ERC PTOP to Gabriel Gutierrez.

Strategies for Equitably Engaging Research Participants and Returning Results.
In 2018, PNASH organized the Vulnerable Populations Workshop for 17 faculty, staff, and students to reflect on what it means to equitably engage with vulnerable populations (Dr. Maria Blancas).[3] In 2020, our outreach team (Dennise Drury, Drs. Maria Blancas and Edward Kasner) hosted a Returning Results retreat for 26 PNASH members to share new approaches for enhancing community engagement, share case examples from colleagues, and workshop plans for returning PNASH results:

- *Anti-Racism, Equity, and Action (AREA) taskforce* to identify opportunities to integrate issues of race and equity into the PNASH Center efforts.
- *New Outreach Grant Proposal Review Criteria with an Equity Focus* to promote diverse stakeholder involvement and enhance translation through adoption, sustainability, and impact.
- *Mapping Assessment of PNASH Contact Reach* was conducted using geographical mapping. This mapped segmented constituency group layers for flexible visual analysis by Producers, Industry, Agency, Academics, Extension, Service. The analysis demonstrated the utility of mapping for internal planning and showed needs for farming outreach in Oregon and Idaho generally, and more specifically for extension and community service organizations.

Training Needs, Research Priorities, Regional Workgroup for Logging and Forestry.
In 2018, our Outreach team (Marcy Harrington and Dr. John Garland) engaged logging contractors and safety professionals to assess needs, set research priorities, and develop resources for training in the logging and forestry sectors.[5] Harrington fostered collaborations in a regional working group among the logging community. Participants included the Associated Logging Contractors of Idaho and the Association of Oregon Loggers.

- *Characterized Loggers Top Logging Safety Priorities.* Polling of 425 members identified: 1) ***Safety Needs*** (training new workers, room on landing zones, mechanized logging, location awareness); 2) ***Hazards*** (difficult terrain, woods roads, cutting, fatigue); 3) ***Health Issues*** (chronic back, muscle, or joint pain, poor sleep, hearing loss); and 4) ***Training Interests*** (fatigue, safety leadership, danger trees, fitness)
- *Organized the Logging Safety Summit and NW Logging Safety Network* in collaboration with a steering committee to share information and prioritize research and training needs for logging safety with 32 key logging safety leaders from WA, OR, MT, ID, and BC Canada. Plans for a 2020 Summit in Idaho were postponed to due to the pandemic, but we have proposed to continue this event during the next cycle.
- *Organized the Forestry Safety Innovations and Populations session* as part of the 2019 Western Regional Conference. Seven presenters discussed logging technology, workforce development needs, and academic interests.

Co-developed Communications about Indigenous Farmworker Safety, Worker Housing, and Healthcare Access. Indigenous agricultural workers experience unique needs and challenges. Outreach team members (Drs. Vanessa Galavíz, June Spector, and Maria Blancas) partnered with community organizations to conduct a community

survey to assess work tasks, access to water and sanitation, work-related injuries, housing conditions, and access to community resources. Research activities were supported through external project funding and included a survey of 348 farmworkers and 24 housing assessments. PNASH Outreach Core advised and supported:

- *Produced the Nothing About Us Without Us: Creating Health Equity video* to highlight the purpose of the project and community-academic partnership.
- *Policy Brief to Highlight Policy Solutions* regarding emerging hazards, immigration-related factors, and potential solutions for farmworkers

Responded to Emerging COVID, Wildfire, and Sexual Harassment Needs with Regional/National Partners. Through the PNASH Emerging Issues Program, the Outreach Core works in collaboration with stakeholders to address new priorities facing the AgFF sector. PNASH focused on building partnerships in response to urgent needs in agricultural communities resulting from the COVID-19 pandemic, rising temperatures, and an increase in wildfires throughout ID, OR, WA, and CA.

Co-Developed Culturally-Centered Bilingual Messages and Resources in Response to the COVID-19. The Outreach Core collaborated with rural organizations, health districts, state agencies, community organizations and researchers to compile and develop resources to increase awareness of the COVID-19 requirements. The goal was to create printed resources and digital media with accessible vocabulary, a visual format, and Spanish language. Idanis Cruz, Elizabeth Torres, and Drs. Blancas and Kasner focused on surveying agricultural stakeholders to assess communications needs and community concerns in response pandemic. In a second effort, Sarah Fish, Dennise Drury, Idanis Cruz, Elizabeth Torres, and Dr. Kasner developed resources on workplace requirements for agriculture, food processing, and temporary worker housing.

- *Assessed needs and co-developed culturally-centered messages for farmworkers* - Through a UW Population Health Initiative pilot, Blancas, Kasner, and Torres partnered with El Proyecto Bienestar, WA Department of Health, and community organizations to support COVID-19 Farmworker Study (COFS). Of the 50 farmworkers surveyed, 65% reported they made a change to their behavior as a result of information from a trusted source (30% news/internet, 10-15% each for work, clinic, family/friends). They co-developed 14 resources in collaboration with community partners about mask use, cleaning practices, and glove use.
- *Launched Responding to COVID-19 webpage* and industry-specific webpages to compile the best training resources and guidance for workers, supervisors, and employers from health authorities in WA, OR, ID, and AK. These pages have been visited over 10,000 times since March 2020.
- *Created resources to communicate COVID-19 workplace requirements for agriculture.* Through PNASH Emerging Issues, Blancas, Cruz, Drury, Fish, Kasner, and Torres partnered with WA Departments of Labor and Industries and Health, WA Grower's League, and Northwest Communities Education Center/Radio KDNA. Developed 15 resources and one photonovela on requirements for agriculture, warehouses, temporary worker housing, and mask use.
- *COVID-19 Agricultural Employer Checklist* to help employers develop and implement workplace prevention programs in English and Spanish viewed over 12,000 times.
- *30 Radio Programs and Public Services announcements with Radio KDNA*. Partnered with Radio KDNA, El Projecto Bienestar, and WA Grower's League to share timely messages in Spanish on safety orders, workplace requirements, and testing and vaccine information on public radio broadcast reaching 25,000 farmworkers in the Yakima Valley.
- *Disseminated 15,000 fliers and 17,000 masks* to workers in Washington State with community partners and launched a social media campaign that reached 40,880 people on Facebook alone.
- *Wildfire Smoke Safety Website and 4 Employer preparedness Checklists* in accordance with new and temporary emergency rules for WA and OR in English and in Spanish.

Co-developed Communications on new State and National Policies for COVID-19, Heat, and Wildfire Smoke Safety in Agriculture. In Year 4-6, the Center collaborated with state, regional, and national partners to provide consultation to inform the development of guidance and workplace requirements for employers. In response to the COVID-19, pandemic, there was an urgent and timely need for guidance on workplace policies and practices to keep agricultural workers safe.[33] Additionally policy needs resulted in response to increased heat and wildfire safety episodes faced by workers in farming and forestry.

- *Contributed to the National Interim COVID-19 Guidance for Agriculture with the NIOSH Ag Centers.* The NIOSH Ag Centers collaborated with NIOSH, CDC, OSHA, FDA, USDA, EPA, and others to develop technical workplace requirements for preventing the spread of COVID-19 in agricultural workplaces.
- *Scientific Consultation to Support Development of State Heat Policy* – Oregon Heat Illness Prevention Temporary Rule[35] and Washington Temporary Emergency Heat Rule in WA.

- *Scientific Consultation to Support Development of State Wildfire Policy* - Oregon Temporary Rule on Protection from Wildfire Smoke[37] and Washington Wildfire Smoke Emergency Rule.
- *36 Radio Programs* through coordinated campaigns on heat-illness, wildfire smoke, and COVID-19 prevention in collaboration with Radio KDNA, WA Grower's League, WA Department of Health, and the WA Department of Labor and Industries in 2020 and 2021.

The following major stakeholder engagement activities by industry included:

Farming

Partnership for Ag Safety and Health

This partnership was established to identify educational needs of agricultural workers and collaborate to develop resources. The group meets bi-weekly and includes participation from: the WA Department of Labor and Industries (WA L&I), WA Department of Health, WA Grower's League, Yakima Health District, UW Health Promotion Research Center, UW Center for One Health Research, El Proyecto Bienestar, and Radio KDNA. In Year 6, WA L&I reached out to us for help communicating the WA workplace requirement for outdoor heat exposure, wildfire smoke exposure, and temporary worker housing requirements for COVID-19. We worked together to develop resources, translating the rules into accessible and visual resources for Spanish agricultural workers.

COVID-19 Farmworker Study (COFS) Collaborative

This group was established to assess the impact of the COVID-19 pandemic on farmworker families and included 20 farmworker organizations in WA, OR, ID, and CA. The PNASH Center provided support with data collection and analysis, and the community-based organizations to lead the development of policy recommendations. Both OR and WA administered surveys and conducted interviews to gather information from farmworkers about their working conditions and access to health and social services during the COVID-19 pandemic. However, each state used different approaches to disseminate the results. OR released findings in 2021 and shared results in webinars, and WA released findings in an interactive data visualization tool released in 2022. Findings from WA and OR showed most workers closely followed safety precautions and highlight how the COVID-19 pandemic created challenges that negatively impacted farmworkers' workplace health and safety, access to healthcare, and financial security. Some key policy recommendations include enhancing the social safety net, housing opportunities, and workplace benefits. Learn more about these research findings from Oregon and Washington.

Ag Safety Days Planning Committee

This group brings together industry, agency, and academic partners to plan Ag Safety Days. They organize sessions responsive to current health and safety needs in farming. WA L&I facilitates the group and participants come from different agencies, organizations and individuals like the WA Dept. of Agriculture, WA Farm Bureau, WA Potato Commission, Yakima Valley OIC, Food Alliance, and local growers. During this funding cycle and in response to request from the Ag industry, the Committee delivered presentations on infection prevention and control, and pesticide safety.

El Proyecto Bienestar – Farmworker Advisory Group

This long-standing community-based partnership focuses on agricultural workers environmental and occupational health issues. Partners include: the PNASH Center, Northwest Communities Education Center/Radio KDNA, Heritage University, and the Yakima Valley Farm Workers Clinic. Activities are guided by the Community Advisory Board comprised of local community members and agricultural workers. During Year 6, the activities focused on co-developing and disseminating Spanish-language radio programming targeted at heat-illness prevention and wildfire smoke safety education.

Fishing

Risk Information System for Commercial Fishing Technical Advisory Board (RISC TAB)

The RISC TAB provides advice and recommendations to the RISC Fishing (P.I. Kincl, NIOSH 2016-2022) study team and propose the development and use of the safety surveillance system. RISC TAB stakeholders include national and state agencies, commercial fishers, public health surveillance practitioners, occupational safety and health researchers, and practitioners in the states of Alaska, Oregon and Washington. An evaluation of our TAB members demonstrated their work influenced the direction of the project. Also TAB members reported positive experiences in participating, which in turn had beneficial implications on their work.

Fishermen First Aid and Safety Trainings (FFAST)

The Fishermen Led Injury Prevention Program (FLIPP), lead by Dr. Laurel Kincl and Amelia Vaughn, created the FFAST program – a first aid class that incorporates wilderness first aid and specific work tasks/situations found on commercial fishing vessels. The FFAST has a technical advisory board is a made up of experts from a variety of fields including fisheries managers, fisheries economists, fishing industry representatives, safety professionals, researchers

from other NIOSH ag centers, and NIOSH personnel. They provide the RISC Fishing team with feedback on all outreach materials and the utility of the commercial fishing injury surveillance system. FFAST recently received a training grant from NIOSH which has allowed them to begin collaborating with partners in Alaska and New England to build capacity for this training.

Forestry

Forestry Safety Working Group

This cycle engaged forestry advisors through ad hoc committees and needs assessments at events (see above). With planning for a new cycle and increased role in forestry, in 2022, we formed the Forestry Safety Working Group (FWG), a standing advisory with a goal to develop new project directions and resources for the Northwest related to logging and forestry services. This team brings a deep understanding of forestry and best forestry practices. Their goals include initiating small education projects and conducting needs assessments. PNASH FWG is facilitated by Ms. Harrington and includes:

- Ernesto Alvarado, Professor, UW School of Forestry
  Steve Barham, Safety Specialist, Associated Contract Loggers of Idaho
  Fransisca Belart, Extension Specialist, OSU School of Forestry
  Edward Boulch, Manger, Logging Safety Initiative, Washington State Dept. of Labor and Industries
- Jacob Delbridge, Policy Advisory, Washington State Dept. of Natural Resources
  Jim Gahlsdorf, President, Gahlsdorf Logging, Oregon
- John Garland, PNASH Affiliate Professor and OSU Professor Emeritus, Garland and Associates
- Rob Keefe, Associate Professor, UI College of Forest and Rangeland Sciences

Aim 2. Develop a research-to-practice plan for each of the Center's projects to ensure that the benefits of our research, interventions, and education are put back into the hands of agricultural workers and producers, health and safety professionals, health care providers, public agencies, and academic institutions.

The Outreach Core has a focus in supporting the research translation and product dissemination for each of the various PNASH projects. Activities include co-development of research-to-practice and media plans in conjunction with the research team and PNASH Evaluation Program. Product assistance includes, online learning courses, articles/blogs, websites, presentations, and developing social media posts. To date, we have worked together with all our project teams working on fishing safety, dairy safety, heat-illness, sexual harassment, and pesticide safety. When a project concludes, we train Outreach Core personnel to serve at trainer/educators on that project's final educational program.

Returning Results Workshop

In 2020, the Outreach Core hosted the Returning Results Workshop to reflect on approaches for engaging and sharing study results with primary agricultural audiences. The goals were to 1) review and update plans to return results from the current cycle, and 2) reconsider the best ways to engage our agriculture, forestry, and fishing partners in future work. To accomplish this, we invited researchers who work with similar communities to show case examples, strategies, and best practices for returning results. An outcome of the workshop was the decision to launch a Returning Results Report annually for our research partners and participants.

Co-developed Ready-to-Use Toolkits with Participatory Approaches for Heat-illness Prevention, Dairy Safety, and Sexual Harassment Prevention. PNASH developed toolkits using a multi-level approach focused on prevention at the organizational and community levels. Toolkits contain resources that can be incorporated directly into workplace policies, practices, and training, and utilized to inform decision-making (e.g. Heat awareness app). These were co-developed with employers, workers, promotorxs, and industry organizations to ensure practicality, effectiveness, and relevance on the farm in English and Spanish.

- *Heat, Education, & Awareness Tools (HEAT) – Adopted by 4 Training Platforms:* WA State Dept of Labor and Industries, Harvust, Inc, Training HR Software, and PNASH Dairy Safety Kit, and Migrant Clinician's Network. It includes a facilitator's guide, training materials, heat awareness mobile app, worksite posters and was co-developed/piloted with promotorxs and workers (Spector 2016-2022).
- *¡Basta! Prevent Sexual Harassment in Agriculture Toolkit – Helped train 562 agricultural stakeholders* during 13 training sessions with 6 growers in WA and OR. Includes training videos, trainer's guide, model workplace policies and procedures, posters and other key resources. Adopted by the BASTA Coalition of Washington, WA Coalition Against Domestic Violence, and Harvust, Inc.
- *Dairy Safety Toolkit – Developed 2 Training Programs*. The Dairy Safety Kit (DSK) interactive digital learning platform with 12 bilingual modules for dairy owners and managers. The Leaders Enabling Advanced Dairy Safety (LEADS) training of trainers certifies managers and owners to deliver animal handling training. DSK was also adopted by WA State Dept of Labor and Industries (Yost 2016-2022).

Aim 3. Implement outreach strategies that are specific to the needs and communication preferences of each stakeholder group.

Co-developed Digital Safety Tools and Training with Community and Agency Partners and e-Learning Platform.

- *21 Practical Solutions for Pesticide Safety* on topics including worker hygiene, pesticide application efficiency and reducing pests in the greenhouse rooms.
- *'Drift Management Best Practices' Training* to enhance drift event documentation and establish an alert system during drift-prone weather conditions with WA Department of Health. Drift findings integrated in WA State Department of Agriculture pesticide applicator training.
- *PestiSeguro™ PestiSafe™ mobile app* for specialty crops in WA launching in 2022. This project developed through Washington state grants is a product related to previous NIOSH funded awards and PNASH continues to support it administratively and with Outreach Core guidance and promotion.
- *New e-Learning Series: Health & Safety Solutions in Agriculture* - a 4-part English/Spanish series with safety modules on sexual harassment, heat, dairy safety and pesticides. The courses included live courses and an online – on demand digital learning platform.
- *Heat-Related Illness Course for Industrial Hygienists*, part of the Principles for the Practicing Industrial Hygienist Series from the UW Continuing Education Program (Spector 2016-2022).
- *Online Training Modules for Infection Prevention and Control on Animal Farms* to help farmers to develop and implement accident prevention programs for COVID and diseases (Rabinowitz 2016-2022).

Data Visualization for Industry and Community Engagement. The Ag Health Indicators Project (Dr. Elena Austin) compiled agricultural injury, demographic, and geographical data sources in the NW region, including PNASH research results into a visual, interactive database. With a community-based partner (Elizabeth Torres) and the RISC Fishing Technical Advisory Board, we tested various visualizations and developed tailored communication materials on well water testing and treatment specifically for this population:[2]

- *Established a Systematic Approach to Collect, Organize and Display AgFF Data* integrated data on WA worker's compensation and well water nitrate concentrations, and OR and WA fisheries injury and fatality.
- *Developed the AgFF Health Indicators Interactive Web-based Database.* Austin developed an iterative visualization platform to allow for partners to assess injury trends and patterns.
- *Established Methods for Translating Data Visualizations into Accessible and Tailored Resources* for commercial fishing injuries database and to promote well water testing and treatment. [2-3]
- *Developed 4 Resources Adopted by Yakima Health District and Water Testing Centers*: 1) Is My Well Water Safe to Drink?; 2) Understanding Your Well Water; 3) Understanding Your Well Water Report: Total Coliform and E. Coli; and 4) Private Wells and Community Needs: Voices from the Yakima Valley.[4]

Surveillance-informed Approaches to Address Training Needs for Fishing, and Dairies. PNASH demonstrated the utility of utilizing surveillance data to develop industry-specific approaches to: 1) identifying hazards and needs, 2) developing training solutions and intervention, and evaluating changes in injuries and fatalities over time. *Developed Fishing Safety Resources Informed by RISC Fishing Findings.* Drs. Kincl and Bovbjerg Risk Information System for Commercial (RISC) Fishing surveillance project developed approaches for using data from the NIOSH Commercial Fishing Incident Database (CFID 2.0)[26] to develop training tools and resources in collaboration with agencies and U.S. Coast Guard and other fishing stakeholders (Kincl 2016-2022).

- *Published 6 RISC Hazard Sheets* on cleaning buoys, ladders and stairs, slips and spills, and more.[27]
- *Developed 5 RISC Findings* with injury prevention tips for falls, musculoskeletal injuries, and more. [27]
- *Created RISC Fishing Data Linkage flier* describing how data is compiled to understand injury-risk. [27]
- *Conducted Fishermen First Aid and Safety trainings* with commercial fishermen in WA and OR.
- *Established "Fishing Fridays"* social media campaign with weekly safety tips and resources.
- *Created Dairy Training Programs in Response to WA Dairies Top Acute Injury Risks.* Drs. Yost and Austin established a methodology to conduct dairy injury surveillance with WA Department of Labor and Industries and implement and evaluate dairy training programs to address top hazards (Yost 2016-2022).
- *Developed 2 Training Program -* Dairy Safety Toolkit and Leaders Enabling Advanced Dairy Safety (LEADS) Training of Trainers.
- *Hosted the "Think Safety, It Won't Hurt" interactive virtual workshop* in partnership with the Washington State Dairy Federation to share solutions and tools with WA dairy industry.

Storytelling as an Education and Engagement Strategy with Farmworkers and Forestry Workers. PNASH developed an approach for utilizing narrative storytelling to develop educational materials using worker stories for Latino forestry workers and Indigenous farm workers. In 2017, De Castro and Harrington partnered with Northwest Forest Worker Center and UC Berkeley to characterize working conditions, safety mitigation efforts, and injury experiences inform the development educational materials in Spanish.[39] In 2019, Dr. Spector and Blancas piloted and adopted a method to conduct farmworker digital story workshops to develop participant-created digital stories in collaboration with community partners.[28]

- *Developed the "Forest Worker Safety Talks"* with real worker stories and tips for delivering training in English and Spanish disseminated to over 300 contract firms throughout WA and OR.
- *Created Reality Tales Videos: Injuries in the Woods*, a series with 5 videos of real workers sharing their injury stories in their own voice in English and Spanish.
- *18 Digital Stories Created by Indigenous Farmworkers* participating in the 3 workshops. Six of these were shared during the 2020 Latino Legislative Day- Farmworker Tribunal - where 100 workers gathered to share their stories and advocate for policy change to protect their health.

Communication Strategies and Tools for Reaching Agricultural Stakeholders. PNASH expanded the reach of its resources by building a stronger web and social media presence (Sarah Fish, Dennise Drury, Idanis Cruz, Marcy Harrington, and Dr. Edward Kasner) through coordinated campaigns with regional and national partners. Collaboration with NIOSH Ag Centers focused on evaluating the impact of social media campaigns as a communications and resource distribution strategy.

- *Improved PNASH Website Navigation and Content Curation* to increase use among stakeholders. Between September 30, 2016 and December 31, 2022, the PNASH website was accessed by 54,184 users and for a total of 181,418 page views. Developed interactive and searchable resource database which features 132 resources in English and Spanish.
- *Launched Dissemination and Evaluation Committee* to develop media kits with promotional content community organizations could use to promote or host PNASH resources through their channels.
- *Created Creative Commons Licensing Guidance* using CC-BY-NC-ND 4.0 licensing to outline process for attribution and reuse of PNASH Products.
- *NIOSH Ag Center Collaboration* established a process to evaluate shared impact of Ag Center YouTube channel and demonstrated coordinated Ag Center campaigns result in increased exposure and YouTube channel produced increased views, watch time and subscriptions. From 2017-2022 collectively published 67 videos and received 81,433 views, and launched 5 coordinated campaigns on heat-illness and farm safetycampaigns on heat-illness and farm safety.

Launched #BeHeatSmart campaign in collaboration with NIOSH Ag Centers and regional partners, including WA State Department of Labor and Industries. The summer 2021 *#BeHeatSmart* campaign collaborated with 12 national and 6 regional partners, featured 124 social media posts, included 6 radio public service announcements and 2 one-hour radio programs, reached 31,000+ people on social media and result in almost 1,000 resource downloads.

Aim 4. Provide regular communications between the Center and the agricultural community and serve as a forum for our stakeholders to discuss issues and resolve emerging problems.

PNASH Network and Public Communications

This cycle, the Outreach Core has focused on enhancing the Center's social media presence, improving website navigation and visual design and establishing a searchable database with AgFF resources and tools.

- *PNASH Contact Database (2,000 contacts).* PNASH has maintained a contact database since our establishment in 1996. This has been regular maintained and is an internal resource for our communications and outreach planning. Contacts are segmented by industry and constituency category.
- *e-News.* PNASH quarterly disseminates and e-Newsletter, using the system Marketo, and also releases timely eblasts on key releases and news. This cycle saw an increase in 300 new subscribers for a total of 1,200 on our e-News distribution list.
- *Website, https://deohs.washington.edu/pnash/.* This cycle we redeveloped our website, improving its overall navigation and focusing on development of online resources with a searchable portal. Our most popular pages this cycle: COVID resources, Heat Illness, Heat Toolkit, Basta Toolkit. The most resources downloads were from our Heat Illness page.

- *Blog, https://deohs.washington.edu/pnash/blog.* A blog hosted on our website and linked to social media is a new media format for our public articles. This is also used in conjunction with our e-News. This cycle released 28 blog posts.
- *Social Media: 'PNASHCenter' on Facebook, Twitter, Instagram, LinkedIn*. The Core works in coordination with regional partners to develop safety campaigns in collaboration to promote safety messages and resources with agricultural workers, supervisors, and employers in English and Spanish. Social media messages and media kits were co-developed with partners and disseminated to enhance social media reach and build capacity within our communities to promote health and safety messages for workers in farming, fishing, and the dairy industry. Our use of social media greatly expanded in the 2016-22 cycle, expanding our use to Instagram (191 followers) and LinkedIn (170 followers) and growth in our Face Book (222 to 551) and Twitter (98 to 386) followers.
- *Radio*. Through the Partnership for Ag Safety and Health, Spanish-language radio programming and public services announcements were developed to share resources, promote campaigns, and provide updates in WA workplace requirements with agricultural communities. Since 2020, the Core has developed 30 one-hour radio programs and 13 public service announcements, each broadcast reaching 25,000 in the greater Yakima Valley.
- *YouTube.* PNASH lists our training videos on the shared Ag Center channel. Our Pesticide Safety video is ranked #4 (for Spanish) and #7 (for English) on the USAg Centers channel and 15,251 views and 97,882 impressions. And our ¡Basta! Prevent Sexual Harassment in Agriculture has had 3,164 views and 73,452 impressions.

PNASH Participation in Safety and Health Events
PNASH is active in sponsoring and participating in as speakers and exhibitors at safety and health events. These events often change annually and average around twenty-five events each year. Following are the events we regularly engage in.

- Washington State Tree Fruit Association Annual Meeting, December
- Washington Dairy Federation Annual Meeting, December
- Washington Governor's Agricultural Safety Days, February, PNASH serves on planning committee
- Council on Forest Engineering (COFE) International Conference, October
- Pacific Marine Expo, November
- Agricultural Safety Council of America, March
- International Society for Agricultural Safety and Health (ISASH) Annual Conference, June

B.3. Competitive Revisions/Administrative Supplements

The Year 6 extension, 2021-2022, was supported through an administrative supplement to PNASH.

B.4. What opportunities for training and professional development did the project provide?

The Outreach Core, in conjunction with the rest of the Center, provides team members with the tools, guidance, and support to thrive in their careers. The Core established the Anti-Racism Equity & Action (AREA) taskforce to identify opportunities to integrate issues of race and equity into the PNASH Center efforts. The taskforce developed additional proposal criteria the Center now uses to review research proposals to assess community engagement and impact.

At the undergraduate level, we will continue to host students through the UW-DEOHS Supporting Undergraduate Research Experiences in Environmental Health (SURE-EH) Program, the UW-Bothell Community-Based Learning and Research (CBLR) Fieldwork Program, and the UW College Assistance Migrant Program (CAMP) Program. At the graduate level, we will continue to support students through the PNASH pilot program, the Northwest Center for Occupational Health and Safety ERC trainee program, quarterly meetups of the student-led Agriculture, Forestry, and Fishing Research Interest Group (AgFF RIG), and the UW Population Health Initiative pilot research grants. We support Research Supplements to Promote Diversity in Health-Related Research (i.e., Diversity Supplements) for trainees with the Center.

B.5. How did you disseminate the results to communities of interest?

See B.2, Aim 4

B.6 - What do you plan to do during the next reporting period to accomplish the goals?

An emphasis for the Outreach Core in the coming period will be final implementation of each projects' media plan and assistance with research-to-practice final objectives. This work is conducted in tandem with the Evaluation Program and project teams to ensure coordination. These activities will include the collection of evidence of adoption and use of our research findings and safety solutions.

C. PRODUCTS

C.1. Publications, conference papers, and presentations

Israel GD, Diehl DC, Galindo S, Ward C, Ramos AK, Harrington M, Kasner EJ. 2020. Extension Professionals' Information Use, Protective Behaviors, and Work-Life Stress During the COVID-19 Pandemic. The Journal of Extension, 58(6), Article 5.

Harrington MJ, Lloyd K. A Case History Introducing the Oregon Ag Seminar Series-Keys to Program and Research-to-Practice Success. Journal of Agromedicine. 2017;22(4):420-424. doi:10.1080/1059924X.2017.1356777. PMID: 28742449; PMCID: PMC5821470.

Garland JJ. 2018. Accident Reporting and Analysis in Forestry: Guidance on Increasing the Safety of Forest Work. FAO Forestry Working Paper No. 2. UNFAO, 2018, Rome, Italy. ISBN 978-92-5-130503-4.

UW Climate Impacts Group, UW Department of Environmental and Occupational Health Sciences, Front and Centered and Urban@UW, 2018. An Unfair Share: Exploring the Disproportionate Risks from Climate Change Facing Washington State Communities. A report prepared for Seattle Foundation. University of Washington, Seattle.

Drury DO, Fish S, Cruz I, Kasner EJ. 2021. Co-developing bilingual messages for agricultural workers: Lessons learned and tips for reaching your audience. Presentation. NIOSH Extramural Communications Community of Practice Meeting February 25, 2021.

Fish S, Drury DO, Cruz I, Blancas M, Harrington MJ, Kasner JK. 2022. Collaborating to promote farmworker safety and health: User-centered content strategy for emergency rule dissemination, Poster Presentation, 2022 International Society for Agricultural Safety and Health (ISASH) Annual Conference.

Kasner EJ, Drury DO, Cruz I. 2022. Co-developing Resources for Wildfire Smoke and Heat-Illness Prevention, Presentation at COVID-19 Supporting Farmworker Call on June 6, 2022.

C.2. Website(s) or other Internet site(s) – include URL(s)

PNASH Resources, https://deohs.washington.edu/pnash/resources
PNASH Blog, https://deohs.washington.edu/pnash/blog
PNASH e-News, https://deohs.washington.edu/pnash/pnash_e-news
PNASH Videos on shared channel, https://www.youtube.com/@USagCenters

Social Media:
https://www.facebook.com/PNASHCenter/
https://twitter.com/PNASHCenter
https://www.instagram.com/pnashcenter/
https://www.linkedin.com/in/pnash-center-aba97118a
https://www.youtube.com/user/USagCenters

C.3. Technologies or techniques

NA

C.4. Inventions, patent applications, and/or licenses

NA

C.5. Other products and resource sharing

MISC.
Blog. New federal grant to improve Northwest agricultural safety and health
Blog. Introducing Print & Ship
Blog. Fatigue Management
Blog. Nothing About Us Without Us
Blog. Fighting children's asthma at home

COVID
Article. COVID-19 for Logging – Practical Advice Article, American Loggers Council
Blog. COVID-19 Guidance and Resources for Agriculture, PNASH
Blog. Co-creating COVID-19 messages for farmworkers, PNASH
Blog. Harvesting Better Health, COVID-19 Safety on the Radio
Blog. Responding to COVID-19, PNASH
Checklist. COVID-19 Agricultural Employer's COVID-19 (English/Spanish)
Flier. Como Lavar y Usar Su Mascarilla de Tela (English/Spanish)
Flier. Cuando debo usar una mascarilla de tela? (English/Spanish)
Flier. When using your mask, be sure to (English/Spanish)
Flier. Safer glove use during COVID-19 (English/Spanish)
Flier. Tips for Cleaning Your Home During COVID-19 Pandemic (English/Spanish)
Flier. Choosing Safer Cleaning Products for COVID-19 (English/Spanish)
Flier. If You Touch It, Disinfect It (English/Spanish)
Flier. Help Us Protect Ourselves from the Pandemic: Wear Your Mask (English/Spanish)
Flier. 7 Requirements for COVID-19 Safety in Ag (English/Spanish)
Flier. 7 Req. for COVID-19 Safety in Food Processing (English/Spanish)
Flier. Temporary Worker Housing WA req. for COVID-19 safety in ag for worker housing (English/Spanish)
Flier. Requirement #1 for Ag: COVID-19 Training flier (English/Spanish)
Flier. Requirement #2 for Ag: Physical Distancing flier (English/Spanish)
Flier. Requirement #3 for Ag: Cleaning flier (English/Spanish)
Flier. Requirement #4 for Ag: Frequent & Adequate Handwashing (English/Spanish)
Photonovela. Trabajemos Juntos Para Sembrar Esperanza (English/Spanish)
Radio Campaign 1. Ante COVID-19 juntos sembramos confianza para cosechar una mejor salud (All Spanish)
- Radio Program 1. Introduction to COVID-19 Radio Campaign with Radio KDNA
- Radio Program 2. COVID-19 General Safety Guidelines with WA Department of Health
- Radio Program 3. COVID-19 Workplace Requirements with WA Department of Labor & Industries
- Radio Program 4. WA State Vaccine plan with WA Department of Health
- Radio Program 5. COVID-19 Resources and Information for Farmworkers with PNASH
- Radio Program 6. Temporary Worker Housing Requirements with WA Department of Labor & Industries
- Radio Program 7. COVID-19 Facts and Myths, and Q&A WA Department of Health
- Radio Program 8. Cleaning and Disinfecting with El Proyecto Bienestar
- Radio Program 9. Farmworkers Experiences having COVID-19 virus
- Radio Program 10. How to prepare to return to our regular activities with WA Grower's League

Radio Campaign 2. Trabajemos juntos para cultivar confianza y cosechar salud - COVD-I9 (All Spanish)
- Radio Program 1. State of Vaccinations in Washington with Yakima Health District
- Radio Program 2. Vaccine Myths and Facts with WA Department of Health
- Radio Program 3. Why it is Important to Stay Safe in the Workplace WA Department of Labor & Industries
- Radio Program 4. Vaccination and COVID-19 Immunity with Yakima Health District
- Radio Program 5. Returning Back to School and Vaccines for Youth
- Radio Program 6. Workplace Safety after the COVID-19 Vaccine WA Department of Labor & Industries
- Radio Program 7. Challenges for Agriculture during COVID-19 with WA Grower's League
- Radio Program 8. Temporary Worker Housing Requirements with WA Department of Labor & Industries
- Radio Program 9. Navigating Paid Leave & Worker's Compensation WA Department of Labor & Industries
- Radio Program 10. ¿Que Onda Con el Calor? PNASH Be Heat Smart Campaign

Radio Campaign 3. Luchando Juntos Contra la Pandemia (All Spanish)
- Radio Program 1. Importance of Getting Vaccinated with Yakima Health District
- Radio Program 2. COVID-19 General Safety Guidelines with WA Department of Health
- Radio Program 3. Cleaning and Disinfecting El Proyecto Bienestar
- Radio Program 4. Maintaining Our Health During Wildfires with WA Department of Labor & Industries
- Radio Program 5. Maintaining Safety and Health While Working in the Heat with PNASH researchers
- Radio Program 6. Community Perspectives of COVID-19 Pandemic
- Radio Program 7. Vaccine Information for Pregnant Women and Children
- Radio Program 8. Temporary Worker Housing Requirements with WA Department of Labor & Industries
- Radio Program 9. COVID-19 Workplace Requirements with WA Department of Labor & Industries
- Radio Program 10. Farmworkers Experiences having COVID-19 virus

Social Media Kit. Preventing COVID-19 safety in Agriculture. (English/Spanish)
Social Media Card Set. 5 Requirements for COVID-19 in Ag (English/Spanish)
Social Media Card Set. Social Distancing Req. for Ag (English/Spanish)
Social Media Card Set. Handwashing Requirements for Ag (English/Spanish)
Social Media Card Set. Cleaning & Disinfecting Req. for Ag (English/Spanish)
Social Media Card Set. Staying Home & Isolating Req. for Ag (English/Spanish)
Social Media Card Set. COVID-19 Safety Training Req for Ag (English/Spanish)
Social Media Card Set. Temporary Worker Housing Requirement Updates (English/Spanish)
Social Media Card Set. Which Mask for Which Task? for Ag (English/Spanish)
Webpage: Responding to COVID-19 (English with Spanish Resources)
Webpage: Download COVID-19 Materials (English with Spanish Resources)
Webpage: COVID-19 Resources for Employees (English with Spanish Resources)
Webpage: COVID-19 Resources for Farming (English with Spanish Resources)
Webpage: COVID-19 Resources for Forestry
Webpage: COVID-19 Resources for Employers
Webpage: COVID-19 Resources for Commercial Fishing
Webpage: COVID-19 US Agricultural Safety and Health Centers

DAIRY

e-Learning series. Health & Safety Solutions in Ag: Injury Prevention on Dairy Farms (English/Spanish)
Media Kit. Partnership for Dairy Safety & Health (English/Spanish)
Social Media Card Set. Healthy Dairy Worker Health & Hygiene
Social Media Card Set. Cow to Keep it Safe Campaign. Campaign Launch. (All English/Spanish)
- Social Media Card Set. Cow to Keep it Safe Campaign. Tips to Reduce Spread of Germs
- Social Media Card Set. Cow to Keep it Safe Campaign. One Health Approach
- Social Media Card. Cow to Keep it Safe Campaign: Allergens
- Social Media Card. Cow to Keep it Safe Campaign: Safe Workplaces
- Social Media Card. Cow to Keep it Safe Campaign: LEADS Training
- Social Media Card. Cow to Keep it Safe Campaign: Dairy Safety Toolkit

Video. Partnership for Dairy Safety and Health
Webpage: Dairy Safety Toolkit (English/Spanish)
Webpage: Partnership for Dairy Safety and Health

FISHING INJURY PREVENTION

Blog. Native salmon set gillnetters in Norton Sound brave big ocean weather
Blog. RISC Information for Commercial Fishing, PNASH
Blog. Safety and Surveillance for Pacific Northwest Fisheries, PNASH
Flier: #Fishing Fridays Social Media Impact
Media Kit. Fishing Fridays collaboration with RISC Fishing share research and build fishing presence
Social Media Card Support your Mental Health
Social Media Card. RISC Fishing Findings: Lower Back Pain
Social Media Card. RISC Fishing Findings: Slips, Trips and Falls
Social Media Card. RISC Fishing Findings: Falls Overboard
Social Media Card. RISC Fishing Findings: Carpal Tunnel
Social Media Card. RISC Fishing Findings: Ladders and Stairs
Social Media Card. RISC Fishing Findings: Good House Keeping
Social Media Card. Banger Bars.

Social Media Card. FLIPP Fishing Survey Results
Social Media Card. Promote Safety to Keep Fishing
Social Media Card. Personal Floatation Devices Gaining Acceptance
Social Media Card. Stay Safe Out There
Social Media Card. Mental Health for Fishermen
Social Media Card. Vaccination in Seafood Industry
Social Media Card. Fishermen First Aid Safety Training
Webpage: Commercial Fishing Safety, PNASH, https://deohs.washington.edu/pnash/fishing-safety

HEAT & SMOKE
Blog. Heat, fire, smoke and health in Washington's ag industry
Blog. Turning Down the Heat for Agricultural Workers
Checklist. Washington Wildfire Smoke Employer Training (English/Spanish).
Checklist. Oregon Wildfire Smoke Employer Training (English/Spanish).
Factsheet. Mattawa Farmworkers' Under the Smoke (English/Spanish)
e-Learning series. Health & Safety Solutions in Ag: Heat-Illness Prevention (English/Spanish)
Flier. Tips for wearing masks in the heat (English/Spanish)
Media Kit. Beat the Heat / Vence al calor - Campaign for Farming, Fishing and Forestry (English/Spanish)
Media Kit. Be Heat Smart Campaign / Qué Onda Con El Calor (English/Spanish)
Poster. ¿CÓMO CONSTRUIR UN FILTRO DE AIRE DE BAJO COSTO?
Radio Public Service Announcement: Be Heat Smart Campaign Goals & Purpose (All Spanish)
- Radio Public Service Announcement: Acclimatization
- Radio Public Service Announcement: Hydration
- Radio Public Service Announcement: Clothing
- Radio Public Service Announcement: Personal Factors for Heat Stress
- Radio Public Service Announcement: Heat Stroke VS Heat Exhaustion

Radio Program. ¿Que Onda Con el Calor?, PNASH Be Heat Smart Campaign (Spanish)
Radio Program. Staying Safe While Working in the Heat, PNASH Be Heat Smart Campaign (Spanish)
Social Media Card Set. Be Heat Smart Campaign: Campaign Launch (Alll English/Spanish)
- Social Media Card Set. Be Heat Smart Campaign: Heat Safety: Employer Responsibility
- Social Media Card Set. Be Heat Smart Campaign: Preparing for WA Heat Rule
- Social Media Card Set. Be Heat Smart Campaign: How to Download Heat Awareness mobile app
- Social Media Card Set. Be Heat Smart Campaign: Heat Acclimatization
- Social Media Card Set. Be Heat Smart Campaign: Heat Index & Mobile App
- Social Media Card Set. Be Heat Smart Campaign: Staying Hydrated
- Social Media Card Set. Be Heat Smart Campaign: Heat illnesses: Signs & Treatments
- Social Media Card Set. Be Heat Smart Campaign: Heat Resources (HEAT Toolkit)
- Social Media Card Set. Be Heat Smart Campaign: Heat Illness Risk Factors
- Social Media Card Set. Be Heat Smart Campaign: Heat Stress & Clothing
- Social Media Card Set. Be Heat Smart Campaign: Prevention Checklist
- Social Media Card Set. Be Heat Smart Campaign: Heat Stress & PPE
- Social Media Card Set. Be Heat Smart Campaign: Keeping Cool in the Community
- Social Media Card Set. Be Heat Smart Campaign: Medications & Heat Illness Risk
- Social Media Card Set. Be Heat Smart Campaign: Heat-related Illness vs. Pesticide Poisoning

LOGGING & FORESTRY
Blog. Fatigue Management for Farming, Fishing, and Forestry, PNASH
Blog. Virtual Training for Wildfire Prevention, PNASH
Training Guide. Forest Worker Safety Talks. (English/Spanish)
Glossary. Spanish Glossary of Forestry Services Terms (English/Spanish)
Trade Article. Logger Poll Results and Safety Leadership.
Videos and Training Cards. Injuries in the Woods / Videos historia Reales: Lesiones en los bosque (All English/Spanish)
- Sueños Americanos / American Dreams
- Tristeza, Soledad Y Esperanza / Sadness, Loneliness and Hope
- Sueños Truncados / Broken Dreams
- Buscando un Mejor Futuro / Searching For A Better Future
- La Vida del Surruchero / The Life of the Forest Worker

PESTICIDES

Blog. New federal grant to improve Northwest agricultural safety and health
Blog. When pesticides drift, PNASH
Blog. Field-tested Pesticide Health Solutions, PNASH
Blog. Bilingual app to keep farmworkers safe, PNASH
e-Learning series. Health & Safety Solutions in Ag: Pesticide Safety Solutions (English/Spanish)
Trade article. Keeping Pesticides on the Farm: Practical solutions for minimizing family exposure.
Trade article. Novel Blood Test Quickly and Accurately Detects Pesticide Exposure.
Trade article. Pioneering technique developed by PNASH teaches pesticide contamination risks.
Trade article. Steering the research on spray drift. Good Fruit Grower.
Trade article. Spray researchers aim to catch their drift: Video. Good Fruit Grower.
Video/DVD. Air blast spray drift study begins. Good Fruit Grower.
Video. EPA Pesticide Safety for Agricultural Workers (English and Spanish).

SEXUAL HARASSMENT

Article. Acoso sexual en industria agrícola sigue bajo la sombra, El Sol de Yakima
Article. Agricultural Sector Sexual Harassment Prevention Toolkit Launched, Columbia Basin Herald
Article. Bandanas Connect Students with Farmworkers, University of Washington - Bothell
Article. Bothell's ¡Basta! Program Wins National Award, University of Washington - Bothell
Article. Effort to Stymie Sex Abuse of Female Farmworkers, University of Washington, Newsbeat
Article. Forum shines spotlight on sexual harassment of farm workers, Yakima Herald
Article. MeToo in the Fields: New Sexual Harassment Video & Curriculum, Migrant Clinicians Network
Article. New Toolkit Aims to Prevent Sexual Harassment in the Agricultural Industry, Yakima Herald
Article. Preventing Sexual harassment in Agriculture, University of Washington - Bothell
Article. Still silenced: sexual harassment of farm workers rarely makes headlines, Yakima Herald
Article. 'We just want to work': Washington farmworkers say enough to sexual assault. Crosscut
Article. Where is the #METOO for sexual harassment against immigrant workers? Seattle Times
Article. University of WA selected for 2020 Carnegie Foundation Community Engagement Classification.
Blog. Sexual Harassment in the Fields, PNASH
Blog. Reaching out for Change on the Farm, PNASH
Facilitators Guide. ¡Basta! Prevent Sexual Harassment in Agriculture (English/Spanish)
e-Learning series. Health & Safety Solutions in Ag: Sexual Harassment Prevention in Ag (English/Spanish)
Poem. ¡Basta! ¡Basta! ¡Basta! By Paula Zambrano
Photo Novela. ¡Basta! We Deserve a Workplace without Sexual Harassment (English/Spanish)
Poster. ¡Basta! Worksite Posters (All English/Spanish)
- 4 Steps to Report Sexual Harassment
- Respect for All
- Respect: Everyone Deserves it
- Respect: Key Ingredient

Powerpoint Slides. ¡Basta! Training Slides (English/Spanish)
Radio Novela. Prevent Sexual Harassment in Agriculture (Spanish)
Toolkit. ¡Basta! Prevent Sexual Harassment in Agriculture Toolkit (English/Spanish)
Video. ¡Basta! Training Videos
- ¡Basta! Training (English/Spanish)
- ¡Basta! Training with Pauses for Training (English/Spanish)
- Grower's as Allies
- Interview with Mike Gempler, WA Grower's League
- Interview with Jeff Perrault, Perrault Farms, Inc.

Wallet Cards. ¡Basta! Wallet Resources Cards (All English/Spanish)
Webpage. Sexual Harassment Prevention, PNASH
Webpage. ¡Basta! Toolkit, PNASH

D. PARTICIPANTS

D.1. What individuals have worked on the project? Please include calendar, academic, and summer months.

Commons ID	S/K	Name	Degrees(s)	Role	Cal	Aca	Sum	Foreign	Country	SS
ejkasner	x	Edward Kasner	PhD	Assistant Professor	12					NA
kitgalvin	x	Kit Galvin	MS, CIH	Research Scientist	9					NA
mjharrington	x	Marcy Harrington	MPA	Manager	7.2					NA
johngar	X	John Garland	BS, MS, PHD	Faculty	3.6					NA
		Sarah Kathleen Fish		Media Specialist	28.8					NA
		Pablo Palmandez	MS	Research Coordinator	7.2					NA
		Idanis Cruz		Research Coordinator	6.0					NA
		Dennise Drury	MPH	Outreach & Education Specialist	32					NA
		Ilsa Olsen	BA	Program Coordinator	1.2					NA
		Jose Carmona	MPH	Research Coordinator	3.6					NA
		Amelia Vaughn		Research Coordinator	1.2					

D.2 Personnel updates

Nothing to report.

E. IMPACT

E.1 - What is the impact on the development of human resources, if applicable?

COVID-19 and Basta! Sexual Harassment Prevention education resources have been in strong demand this year, with measured use by Northwest agricultural employers, agencies, and other farmworker-serving community organizations.

E.2 - What is the impact the Public Health Relevance and Impact? The investigator should address how the findings of the project relate beyond the immediate study to improved practices, prevention or intervention techniques, legislation, policy, or use of technology in public health.

We wuse best ractices for community-engaged research approaches to collaborate with employers and employees. This enables the Center to utilize interdisciplinary perspectives, maintain a deep respect for the communities' cultures and lived experiences, and enable researchers to be observers in the communities they enter. As researchers, we have the capacity to enter and exit communities and therefore carry the responsibility of empowering communities beyond funding cycles. Exiting a research site is as important as entering it, particularly in those with marginalized workers. With this in mind, the Outreach Core places particular emphasis on 1) returning research progress, results, and workplace solutions in a timely manner with participants, partners, and the public, and 2) sustaining opportunities that empower organizations to adapt our safety and health resources for their own communities.

F. CHANGES

F.1 - Changes in approach and reasons for change, including changes that have a significant impact on expenditures
NA

F.2 - Actual or anticipated challenges or delays and actions or plans to resolve them
NA

F.3 - Significant changes to human subjects, vertebrate animals, biohazards, and/or select agents
NA

G. Special Reporting Requirements

G.1 Special Notice of Award Terms and Funding Opportunities Announcement Reporting Requirements
NA

G.2 Responsible Conduct of Research
NA

G.3 Mentor's Research Report or Sponsor Comments
NA

G.4 Human Subjects

G.4.a Does the project involve human subjects?
No

G.4.b Inclusion Enrollment Data
NA

G.4.c ClinicalTrials.gov
Does this project include one or more applicable clinical trials that must be registered in ClinicalTrials.gov under FDAAA?
No

G.5 Human Subject Education Requirement

Are there personnel on this project who are newly involved in the design or conduct of human subject's research?
No

G.6 Human Embryonic Stem Cells (HESCS)

Does this project involve human embryonic stem cells (only hESC lines listed as approved in the NIH Registry may be used in NIH funded research)?
No

G.7 Vertebrate Animals

Does this project involve vertebrate animals?
No

G.8 Project/Performance Sites
University of Washington, Seattle, WA

G.9 Foreign Component
NA

G.10 Estimated Unobligated Balance
G.10.a Is it anticipated that an estimated unobligated balance (including prior year carryover) will be greater than 25% of the current year's total approved budget?

No

G.11 Program Income

Is program income anticipated during the next budget period?
Yes

G.12 F&A Costs

Is there a change in performance sites that will affect F&A costs?
No

I. OUTCOMES

I. Provide a concise summary of the outcomes or findings of the award, written for the general public in clear and comprehensible language, without including any proprietary, confidential information or trade secrets

Note: project outcome information will be made public in NIH RePORTER

The PNASH Center's Outreach and Education Core builds relationships and shares information with agricultural communities. To help meet our goals, the Core is organized into four committees shown in graphic below. In Year 6, the Outreach Core: 1) collaborated with individual PNASH Projects to promote resources through coordinated campaigns, 2) developed new resources in response to emerging needs resources through such as wildfire smoke and heat; and 3) established new funding opportunities to foster new partnerships with industry and community partners to expand the reach of PNASH resources in agricultural communities.

Resources - https://deohs.washington.edu/pnash/resources

Identifying Regional Needs
The Outreach Core works in partnership with agricultural stakeholders and research teams to identify and respond to regional health and safety needs. The Needs Assessment Committee leads the engagement in regional advisories with agricultural workers and employers, community organizations, academics, and agencies.

Co-developing Resources with Agricultural Communities
We work in collaboration with agricultural stakeholders co-develop, disseminate, and evaluate resources, tools, and solutions for the agricultural community. The Translation Committee leads these activities by leveraging existing

partnerships with state agencies, health and safety trainers, industry groups, and community-based organizations to share the latest resources for best practices for engaging our communities.

Education and Engaging with Agricultural Stakeholders

Outreach enhances PNASH's presence by participating in events, meetings, and conferences throughout the Pacific Northwest and nationally. We share our research results and deliver model training programs. Our new Outreach Mini Grants (https://deohs.washington.edu/pnash/mini-grants) and Outreach Supplements to pilot research, connect us to regional partners to extend our research tools and results into practice.

Website

We have redeveloped our website promoting resources, toolkits and online learning courses for workers, supervisors, employers, and safety professionals in English and Spanish. PNASH eNews and blogs highlight our findings, stories, events and research activities. See https://deohs.washington.edu/pnash.

Radio

Through the Partnership for Ag Safety and Health, Spanish-language radio programming and public services announcements were developed to share resources, promote campaigns, and provide updates in WA workplace requirements with agricultural communities. June Spector and Maria Blancas hosted radio programming on heat-illness prevention. Idanis Cruz and Laura Rivera from Wenatchee Café hosted radio programming on wildfire smoke safety. Since 2020, the Core has developed 30 one-hour radio programs and 13 public service announcements, each broadcast reaching 25,000 in the greater Yakima Valley.

Social Media

We work in coordination with regional partners to develop safety campaigns in collaboration to promote safety messages and resources with agricultural workers, supervisors, and employers in English and Spanish. Social media messages and media kits were co-developed with partners and disseminated to enhance social media reach and build capacity within our communities to promote health and safety messages for workers in farming, fishing, and the dairy industry. Connect to 'PNASHCenter' on FaceBook, Twitter, Instagram, LinkedIn.

A. COVER PAGE

Project Title: Austin – Pilot/Feasibility Project Program	
Grant Number: 5U54OH007544	**Project/Grant Period**: 09/30/2016 – 09/29/2022
Reporting Period: 09/30/2016 – 09/29/2022	**Date Submitted**: 12/28/2022
Program Director/ Principal Investigator 2016-2021 CATHERINE KARR, PhD, MD, MS Phone number: 206-616-4355 Email: ckarr@uw.edu 2021-2022 ELENA AUSTIN, PhD, MS Phone number: 206-221-6301 Email: elaustin@uw.edu	**Administrative Official Information** CAROL RHODES University of Washington Office of Sponsored Programs 4333 Brooklyn Ave NE SEATTLE, WA 98105 Phone number: 206-543-4043 Email: osp@uw.edu
Change of Contact PD/PI: NA	
Human Subjects: UW IRB #3851, 11/01/2021 – 10/31/2022	**Vertebrate Animals:** No
hESC: No	**Inventions/Patents:** No

B. ACCOMPLISHMENTS

B.1. What are the major goals of the project?

Pilot/Feasibility Project Program

The PNASH Center administers a Pilot Project Program (PPP) to support new initiatives in research, intervention, and translation. The goal of the PPP is to stimulate and support new and expanded research, prevention/intervention, and education/translation activities in the area of occupational safety and health in Northwest farming, forestry, and fishing.

The program followed the mechanism previously developed and implemented by the PNASH Center. This is a formal process that includes: 1) release of a request for proposals for Northwest investigators; 2) internal and external review and scoring of proposals; 3) notification of award or request for revision and resubmission; and 4) a record of program process and project results.

Previously funded pilot projects have allowed the Center to address emerging issues, bring in new investigators, and address needs/industries not included in other projects.

This program provides both early stage and experienced investigators with opportunities to:

- Develop preliminary data or expertise to support new proposals,
- Adapt or evaluate proven tools or techniques for new populations, workplaces, or delivery methods,
- Evaluate the merit of new ideas, or new approaches to existing methodologies or datasets,
- Explore new directions in research, prevention/intervention, and education/translation,
- Apply their expertise to the field of agricultural safety and health, and
- Leverage emerging technologies in supporting a healthy, safe, and productive AgFF workplace.

In addition, the PPP, places a special emphasis on supporting meritorious projects that widen PNASH's work in the industries of fishing and forestry, and projects that support early-stage investigators.

B.2. What did you accomplish under these goals?

In the 2016-2021 cycle, The PPP program was administered annually with 2-3 projects funded at $25,000 per project, with increased funding in Year 6. Over the Center's 23 years, it has funded 56 pilot or feasibility projects, including 14 in the 2016-2021 cycle.

2021-2022

Characterizing Determinants of Stress, Fatigue, and Injury Risk in Log Truck Drivers (2021-2022)

PI: Marissa Baker, Assistant Professor, UW Environmental and Occupational Health Sciences

Loggers and log truck drivers are at high risk for fatigue and stress, due to long working hours and high job demands. Few studies have characterized the determinants of fatigue, risks, and solutions for this vital workforce. In partnership with industry leaders and safety professionals, this project aimed to understand the determinants of stress and fatigue among loggers and log truck drivers to inform potential solutions. This project developed from Idaho industry concerns over a spike in log trucking accidents. We conducted a survey at the Intermountain Logging Conference and followed up with phone interviews. Secondly, we quantitatively analyzed NW log truck accident data, from workers compensation data in Idaho, and for the NW, the Federal Motor Carrier Safety Administration's Motor Carrier Management Information System (MCMIS).

Preliminary results of 46 loggers surveyed identified concerns of: sleep & fatigue, work schedules, job demand & support, and injury. Although in general, respondents reported few life stressors, and good physical health, quality of life, including on-the-job safety support. A report of preliminary results that will be shared back to industry partners to refine interpretation of results and discuss solutions. Future work could include uses of MCMIS data, and fatigue awareness and prevention strategies. The study team will be publishing these findings in 2 papers and reporting back results to our participants at the 2023 Intermountain Logging Conference.

Stressors of balancing childcare, work, and concerns about ambient exposures on personal well-being and work presenteeism for farmworker parents during and after the COVID-19 pandemic (2021-2022)

PI: Savannah D'Evelyn, Postdoctoral Fellow, UW Environmental and Occupational Health Sciences

Working outside in the heat and wildfire smoke makes summer farm work grueling. But for parents, these challenges are compounded by the pressure of balancing work and childcare, and concerns about their children's health in the smoke. Farmworkers also have few wildfire and smoke information sources that are non-written or in Spanish

This community-academic project sought to describe the impact of wildfire smoke has on agricultural families' ability to balance work, childcare, and concerns about smoke exposure. Our purpose was to identify community needs, priorities during wildfire season, and propose solutions to support the health and well-being of farmworker families. In collaboration with Wenatchee-based nonprofit Community for the Advancement of Family Education (CAFÉ), 20 agricultural families were recruited for interviews to share their experiences and concerns during wildfire season. Two 'Clean Air – I Care' Community Discussions were organized, in Wenatchee and Okanogan, with 80 participants. During these events, findings from the interviews were shared, roundtable discussions were facilitated, and resources were shared with participants in Spanish. "The events were focused on hearing from farmworkers," said Savannah D'Evelyn, who co-led the project with Laura Rivera of Wenatchee CAFÉ. Community partners including Clean Air Methow, Northwest Justice Project, and other local organizations also provided resources

Six major themes identified core needs in: Preparing homes for smoke events, worksite resources for smoke events, worksite response, more accessible summer childcare, family stress, and resources for parents. he Clean Air – I Care team is preparing a report highlighting farmworkers' comments for sharing with community organizations, i.e. childcare and health care providers. Recommendations and resources will be presented back to community organizations.

Pesticide Exposures and Risk Perceptions among Male and Female Latinx Farmers in Idaho (2021-2022)
PI: Carly Hyland, Postdoctoral Research Scholar, University of Idaho College of Health Sciences
Previous studies have documented high levels of pesticide exposure among Latinx farmworkers. However, most research has focused almost exclusively on men, despite women representing an increasing proportion of the agricultural workforce. Some studies have indicated that women farmworkers experience Acute Pesticide Poisonings (APPs) at significantly higher rates than their male counterparts.

Our goal was to examine pesticide exposure and perceptions of pesticide risk, to assess determinants of pesticide exposure among men and women Latinx farmworkers in Idaho. We used a combination of urinary biomonitoring for common insecticides and herbicides, questionnaires, and open-ended qualitative interviews. We recruited 62 participants through partnerships with trusted community organizations during the pesticide spray season from April-July 2022. We conducted a second visit with 57 of those participants. We are currently conducting data analysis to examine predictors of pesticide exposure, including differences by gender, and preparing manuscripts for publication. We are working with PNASH and other science translation teams to interpret these results and disseminate our findings to participants and community partners.

Exploring Decision making among Alaska Native Commercial Salmon Set Netters (2021-2022)
PI: Leann Fay and Jerry Dzugen, AMSEA
The salmon set gillnet fishery has the highest fatalities in Alaska and fatalities for Alaska Native workers are on the rise. Ten out of fifteen fatalities from commercial fishing vessel disasters in Alaska from 2010-2014 occurred in open skiffs, the type of vessel used in salmon set gillnetting. Emergency equipment such as CO2 cartridges in inflatable PFDs cannot be easily or affordably shipped to remote fishing villages in Norton Sound and commercial fishing safety training there has not been tailored for open skiff fishing or for the unique needs and knowledge of fishermen there.

This community participatory project in Unalakleet, an Alaska Native salmon fishing community, aimed to understand factors that influence safety for salmon set gillnetters in Norton Sound. Ten semi-structured interviews were conducted to understand factors that influence safety. The interviews covered questions on how they learned to fish, crew dynamics, boats, equipment, preparation, training, weather, experiences that felt unsafe, challenges, and lessons, stories, or knowledge they wanted share. AMSEA is in the process of developing a training to be held in Unalakleet, sharing research findings, and distributing 30 inflatable PFDs with training and an assessment of PFD preferences. Research findings and next steps for future education, training, resources, and research will be discussed at the training. Findings will be used in the future to improve awareness, promote solutions, and develop tailored training programs for this population and fishery.

2019-2021
Sexual Harassment Prevention in Agriculture: Evaluating a Training Video and Curriculum (2019-2021)
PI: Jody Early, UW Bothell
The ¡Basta! Prevent Sexual Harassment in Agriculture toolkit is a tailored worksite resource developed in collaboration with the agricultural community in a previous PNASH project. The purpose of this project was to evaluate the effectiveness of the ¡Basta! training video and curriculum. A pre/post-questionnaire was developed to assess participant's knowledge, attitudes, and beliefs (in both English and Spanish) before and after a one-hour training session. Results showed that participants' knowledge and attitudes scores significantly increased after the training. 562

agricultural workers, supervisors, and growers have been trained in 13 training sessions and 6 growers in Oregon and Washington invited us to deliver training.

The ¡Basta! toolkit won the 2020 APHA Public Health Education & Health Promotion award and has been adopted by the WA State Coalition Against Domestic Violence, WA Human Rights Commission, and Harvust Inc. Additional resources for the toolkit have been developed, such as a comic titled ¡Basta! We Deserve a Workplace without Sexual Harassment. This comic was developed in collaboration with Latina farmworkers and uses a narrative format based on real stories.

The findings from this pilot study are being used to develop a longer survey to assess additional factors such as sexual harassment experiences and workplace climate. In addition, we will continue to expand the resources for Basta! Toolkit.

Smoke Monitoring for Agricultural Safety & Health (SMASH) (2019-2021)
PI: Edward Kasner, UW Department of Environmental and Occupational Health Sciences
The aim of this pilot was to develop wildfire decision aid tools for growers, driven by data from a high density network of low-cost air quality monitoring sensors. This pilot study demonstrates proof-of-concept for air quality monitoring based on Washington State University's AgWeatherNet platform. Our results from before and during an intense wildfire smoke episode in 2020 indicated that local sensor startup company Thingy:AQ's smoke sampling platform provides a strategy to increase access to real-time air quality information in rural areas where monitoring networks are sparse. Our project partnership has connected Thingy:AQ with wine and tree fruit industries. As a result, they have become heavily involved in new precision agriculture "smart farm" initiatives, such as innov8.ag and agaid.org.

The project team has responded to requests for public technical comments in 2021 smoke and heat rulemaking efforts in Washington and Oregon states. This project's technology and identified risk factors for agriculture were presented locally and nationally at the 2021 Washington Ag Safety Day, 2021 Washington
State Tree Fruit Association Annual Meeting, and in a 2021 AgriSafe webinar.

In addition to the permanent deployment of a Thingy:AQ sensor at a Wenatchee regulatory air monitoring site, this project's work will continue with the goal of deploying 30 additional Thingy:AQ sensors on the AgWeatherNet platform. Spinoff proposals have been written for two upcoming grant opportunities to test and develop this system for Washington growers and related proposals have been funded for smoke taint research in local agriculture.

Use of Unexpected Events and Management Requiring Conditions in the Training and Management of Loggers (2019-2021)
PI: Kevin Lyons, Oregon State University
Forestry work takes place in a natural and largely uncontrolled environment. Traditional logging jobs such as choker setting with rigging crews continue to suffer severe injuries and fatalities. In addition, new logging methods such as tethered ground-based systems are being introduced where there is little practical experience on which to base risk assessment. This pilot project developed a novel system, using a simulated environment (John Deere Forest Harvesting Simulators), where workers identified potential safety concerns and assigned a severity rating to the safety concerns. Results showed that simulated incident scenarios provide an alternative training environment where workers can gain some experience, over a wide range of incidents, in a short time and safely. Study results will help shape future Northwest logging training programs using simulated scenarios.

Systemic Evaluation of Exoskeletons in Reducing Musculoskeletal Disorders in Manual Timber Felling (2019-2021)
PI: Jay Kim, Oregon State University
Logging represents one of the most dangerous occupations, with high fatal and non-fatal injuries, particularly with timber falling. The physically demanding nature of the work is challenged by steep ground and adverse weather conditions with unstable footing. This pilot project sought solutions to reduce physical risk factors and injuries for hand timber fallers by introducing exoskeletons as an ergonomic control. We surveyed loggers to identify potential barriers and unintended safety hazards associated with exoskeleton use. Survey results showed that while the forestry workers were not familiar with exoskeletons, they expressed considerable interest and acceptance for their use in the forestry industry.

Data from the survey results have been analyzed and will be disseminated through a peer reviewed journal article. These results suggest that given the high prevalence of musculoskeletal pain in the low back and upper extremities, evaluating exoskeleton support

of these areas would be a reasonable first step in a future study. Overall, the results suggest that passive exoskeletons, which are lighter, simpler in structure, and more portable than active exoskeletons, may be a good candidate for forestry settings and inform a future study including field-testing with loggers in real forest conditions.

2018-2019

Evaluation of Wearable-Based Activity Recognition Modeling Applications for Logging Safety (2018-2020)
PI: Robert Keefe, University of Idaho Experimental Forest
Logging consistently has among the highest fatality rates in the US. While increased mechanization has improved safety for loggers, ground crews, rigging workers, and hand fallers are still at risk. This small project piloted the integration of geospatial technology and activity recognition modeling into a Garmin smartwatch and smartphone application for rigging crew workers in the logging industry. The aim was to improve loggers' situational awareness by providing real-time updates of their coworkers' work activity status, location, and smart alerts. Model testing demonstrated 80% accuracy in predicting work activity and person down status. Results from the Idaho logger evaluations indicated favorable intent to adopt wearable based activity recognition systems.

Through a presentation to the Council on Forest Engineering and International Symposium on Forest Mechanization (FORMEC), the project team initiated a broader discussion on ethical considerations associated with using wearable data in the workplace in forestry. This project's research presented at FORMEC 2021 was selected by the scientific committee for the 'Best Presentation' award from among 120 talks given globally.

This pilot led to the Forestry Health Monitoring proposal, included the 5-year awarded project in PNASH's 2022-2027 renewal.

Nitrate Well Water Testing in Agricultural Communities: Improving Environmental Health Communication with Health Behavior Theory (2018-2020)
PI: Elena Austin, UW Department of Environmental and Occupational Health Sciences
The U.S. Safe Drinking Water Act does not regulate private wells, leaving over 42 million residents with little oversight of their water quality. Elevated levels of nitrate in groundwater are a significant public health concern for private well water users in the Lower Yakima Valley, which has a large Latino farmworker community. This pilot project developed a process for tailoring communication materials that promote well water testing specifically for this population. Our project was guided by a committee of local stakeholders of the Lower Yakima Valley (LYV) in Washington State, including El Proyecto Bienestar and the Latino Community Fund.

PNASH's partnership in El Projecto Bienestar and dissemination of results continued beyond the completion of the pilot. In addition, based on the results of this project, published in BMC Public Health, Dr. Elena Austin was appointed as a member of the Reducing Health Impacts of Reactive Nitrogen in Ground and Surface Water from Agricultural Sources: An Environmental Health Matters Workshop to Identify Opportunities for Leadership Planning Committee of the National Academies of Sciences, Engineering, and Medicine. This committee guides policy, technology and communication strategies to address groundwater contamination from agricultural sources.

Northwest Safety Summit for Safety Professionals in the Logging Sector (2018-2019)
PI: John Garland, Oregon State University
PNASH sponsored a NW Logging Safety Summit, convening logging safety educators, consultants and researchers from across the greater NW in a one-day collaborative forum to cross-train and discuss key regional issues in logging safety. Participants joined from across WA, OR, ID, MT, on February 20, 2018 in Springfield, Oregon.

The inaugural Safety Summit was successful in forming a network of on-the-ground educators, and forming a bridge between research and practice. The Summit's face-to-face interactions and discussions helped in the sharing of ideas and best practices across Northwest states and organizations. Participants saw value in the Summit and endorsed continuing the network and sharing responsibility for hosting future Safety Summits. The Intermountain Region was suggested as the next location and Idaho Associated Logging Contractors volunteered to host. PNASH will continue to engage with this new network with assistance in the sharing of research results, best practices, and the responding to new research needs.

2017-2018

An Agricultural Worker Data Repository and Interactive Visualization (2017-2018)
PI: Elena Austin, UW Department of Environmental and Occupational Health Sciences
This pilot project served as the base for an ongoing system to Collect, Organize and Display data (Data COD) related to agricultural workers and communities in the Pacific Northwest. The repository stores worker and community health

information, including employment demographics, injury profiles, environmental justice indicators, and emerging issues. The goal of the project was to collect, curate, and disseminate the data into a web-based platform with interactive maps that can be accessed by researchers and the public.

Respiratory Health and Indoor Air Quality in Washington's Cannabis Industry (2017-2019)
PI: Christopher Simpson, UW Department of Environmental and Occupational Health Sciences
This pilot study of workers in cannabis production assesses airborne contaminants and evaluates associated airway inflammation and/or respiratory symptoms. Our goal is to provide solutions to the industry to improve workplace safety and reduce occupational exposures. This project was funded in part by PNASH's Emerging Issues Fund and the Washington State Department of Labor and Industries' Safety and Health Investment Projects to respond to an emerged health concern in this industry.

Marijuana is now medically legal in 38 states and recreationally legal in 11 states, including Washington, Oregon and Alaska. Due to the drug's illegal history, there is a lack of scientific study on the occupational hazards for this workforce. A recent report identified 23 potentially hazardous exposures, and with the rapid growth of the cannabis industry, there is now a large worker population with potential exposures. This pilot research aimed to improve occupational health for cannabis production workers, by quantifying the specific hazards potentially associated with respiratory health concerns, and identifying appropriate industrial hygiene solutions to mitigate those hazards. Broadly, the pilot will build the research base of this emerging industry.

Recognizing and Reducing Risks in the Northwest Potato Industry (2017-2019)
PIs: Carly Hyland, Boise State University
This pilot project was conducted in collaboration with two organizations actively invested in fostering a safe and healthy environment for workers in the potato industry, the Washington State Potato Commission, and the Idaho Potato Commission.

The purpose of this pilot study was to work with potato growers in Idaho and Washington to understand growers' perceptions of the most problematic safety hazards associated with potato production. Ten Hazard Sheets were created in response to the ten most common hazards that potato growers identified in the Hazard Perception Survey. This study then aimed to assist growers in mitigating safety hazards using a guided hazard self-assessment tool. This tool encourages growers to stop, watch, and identify safety hazards at their own operations, and provides recommendations on how to address these hazards. The Hazard Self Assessment Tool (HSAT) was distributed to 900 potato growers throughout Idaho and Washington. The HASAT is a model tool being presented to other AFF industries and safety researchers.

This pilot established a new partnership with WA and Idaho potato growers. This successful partnership has led to new project directions. For example, the WA Potato Commission's partnership in a new PNASH project providing pesticide label safety information in an app in both Spanish and English.

B.3. Competitive Revisions/Administrative Supplements

FY 2021-2022 was supported through an administrative supplement, allocating 180,000 Dc to our P/FP Program.

B.4. What opportunities for training and professional development did the project provide?
One of the primary goals of the P/FP Program is to provide research development and mentorship opportunities for new investigators and graduate students. This past cycle, all of our projects support early career investigators. Projects under this program have also provided additional opportunities for student education and field experiences.

B.5. How did you disseminate the results to communities of interest?
Dissemination activities of the P/FP Program include identifying investigators in the northwest region and sharing the small grant opportunity. We reach these stakeholders using electronic communications such as email, e-news, and our website, and promotional fliers posted on bulletins in departments and programs at the UW. The e-media is sent to over 200 investigator contacts in our network and new investigators serving similar communities at regional research institutions with public health programs.

Each pilot project has an R2P component and is required to include research dissemination activities including returning results to participants, developing educational materials, or providing recommendations to influence practice.

B.6 - What do you plan to do during the next reporting period to accomplish the goals?

This program period has closed. This program and updated guidelines have been funded in PNASH's renewal for cycle 2022-20027 with our next call for proposals to be released in Spring 2023.

C. PRODUCTS

C.1. Publications, conference papers, and presentations

Cannabis

Ehrlich T, Simpson C, Busch Isaksen T. Sociopolitical Externalities Impacting Worker Health in Washington State's Cannabis Industry. Annals of Work Exposures and Health. 2020 Aug 6;64(7):683-692. doi: 10.1093/annweh/wxz083. PMID: 31785200. PMCID PMC9756854.

Ghodsian N. Health Effects of Exposure to Cannabis in Workers in an Indoor Growing Facility. 2019 Master's Thesis. Department of Environmental and Occupational Health Sciences, University of Washington, Seattle, Washington. ResearchWorks.

Sack C, Ghodsian N, Jansen K, Silvey B, Simpson CD. Allergic and Respiratory Symptoms in Employees of Indoor Cannabis Grow Facilities. Annals of Work Exposures and Health. 2020 Aug 6;64(7):754-764. doi: 10.1093/annweh/wxaa050. PMID: 32459852; PMCID: PMC7407609.

Silvey B. Characterization of Occupational Exposure to Airborne Contaminants in an Indoor Cannabis Production Facility. 2019 Master's Thesis. Department of Environmental and Occupational Health Sciences, University of Washington, Seattle, Washington. ResearchWorks.

Silvey B, Seto E, Gipe A, Ghodsian N, Simpson CD. Occupational Exposure to Particulate Matter and Volatile Organic Compounds in Two Indoor Cannabis Production Facilities. Annals of Work Exposures and Health. 2020 Aug 6;64(7):715-727. doi: 10.1093/annweh/wxaa067. PMID: 32696065; PMCID: PMC7407603.

Simpson C. Occupational Health and Safety in the Cannabis Industry. Annals of Work Exposures and Health. 2020 Aug 6;64(7):677-678. doi: 10.1093/annweh/wxaa068. PMID: 32696046. PMCID PMC9769117.

Forestry Monitoring

Keefe RF, Wempe AM, Becker RM, Zimbelman EG, Nagler ES, Gilbert SL, Caudill CC. Positioning Methods and the Use of Location and Activity Data in Forests. Forests. 2019, 10(5):458.

Keefe RF, Zimbelman EG, Wempe AM. Use of Smartphone Sensors to Quantify the Productive Cycle Elements of Hand Fallers on Industrial Cable Logging Operations. International Journal of Forest Engineering. 30(2):132-143, DOI: 10.1080/14942119.2019.1572489

Nitrate Well Water

Vandergeest K. We are All Here to Learn: A Qualitative Study on Private Well Stewardship Within a Rural, Agricultural Latino Community. 2019 Master's Thesis, Department of Environmental and Occupational Health Sciences, University of Washington, Seattle, Washington. ResearchWorks.

VanDerGeest K, Ko LK, Karr C, Torres E, Drury D, Austin E. Private Well Stewardship Within a Rural, Agricultural Latino Community: A Qualitative Study. BMC Public Health. 2020 Jun 5;20(1):863. doi: 10.1186/s12889-020-08963-4. PMID: 32503551; PMCID: PMC7275588.

Potatoes

Curl C, Adams K, Phinney R, Blua M. Grower Perceptions of Safety Hazards and Associated Injuries among Farmworkers Involved in Northwest Potato Production. Journal of Agromedicine. 2021 Apr;26(2):174-184. doi: 10.1080/1059924X.2020.1770645. Epub 2020 Jun 9. PMID: 32516067. **PMCID Pending**

Sexual Harassment

Early, J and Drury D. ¡Basta! Prevent Sexual Harassment in Agriculture. APHA. 2020 National Meeting. Occupational & Env Health Section. October 25, 2020.

Drury D, Torres E, Vásquez VB, Early J. Sexual harassment prevention in agriculture: Evaluating a tailored and multi-level training video and curriculum. In APHA's 2020 VIRTUAL Annual Meeting and Expo (Oct. 24-28) 2020 Oct 25. American Public Health Association.

Kim NJ, Vásquez VB, Torres E, Nicola RM, Karr C. Breaking the Silence: Sexual Harassment of Mexican Women Farmworkers. Journal of Agromedicine. 2016;21(2):154-62. doi: 10.1080/1059924X.2016.1143903. PMID: 26797165; PMCID: PMC5957069.

Smoke Monitoring

Austin E, Kasner E, Seto E, Spector J. Combined Burden of Heat and Particulate Matter Air Quality in WA Agriculture. Journal of Agromedicine. 2021 Jan;26(1):18-27. doi: 10.1080/1059924X.2020.1795032. Epub 2020 Jul 30. PMID: 32730190; PMCID: PMC8171194.

Zuidema C, Austin E, Cohen MA, Kasner E, Liu L, Busch Isaksen T, Lin KY, Spector J, Seto E. Potential impacts of Washington State's wildfire worker protection rule on construction workers. Ann Work Expo Health. 2022 Apr 22;66(4):419-432. doi: 10.1093/annweh/wxab115. PMID: 34935028; PMCID: PMC9030230.

C.2. Website(s) or other Internet site(s) – include URL(s)

Pilot Project Program webpage: https://deohs.washington.edu/pnash/blog/2019-20pilots

PNASH Research webpage: https://deohs.washington.edu/pnash/research

C.3. Technologies or techniques

Dr. Keefe's project has developed a preliminary mobile app extension to model rigging crew work activities.

C.4. Inventions, patent applications, and/or licenses

Not applicable

C.5. Other products and resource sharing

Simpson C. Something Old, Something New: Potential Occupational Hygiene Concerns in the Cannabis Industry. International Society of Exposure Sciences Newsletter, Nov 2017, issue 3, pp. 11-14.

Fliers: Potato Hazard Sheets, https://sites.google.com/boisestate.edu/potential-hazards/hazard-sheets?authuser=0

Tool: Hazard Self-Assessment Tool (HSAT), https://sites.google.com/boisestate.edu/potential-hazards/hsat-forms?authuser=0

Training:

¡Basta! Prevent Sexual Harassment in Agriculture presentations:

Date	Title	Org	Location	Audience	Language	# Participants
9/25/2020	9/25/2020 National Farm Safety & Health Week	AgriSafe	Online (National)	Growers, researchers, educators	English	67
10/16/2020	Focus Group	Farmworker Advisory	Online	Farmworkers	Spanish	4
10/20/2020	Focus Group	Farmworker Advisory	Online	Farmworkers	Spanish	4

D. PARTICIPANTS

D.1. What individuals have worked on the project? Please include calendar, academic, and summer months.

Commons ID	S/K	Name	Degrees(s)	Role	Cal	Aca	Sum	Foreign	Country	SS
ckarr	x	Catherine Karr	MD, PhD	Associate Professor						
mjharrington	x	Marcy Harrington	MPA	Manager	SEE PLANNING AND EVALUATION CORE REPORT					
	x	Ilsa Olsen	BA	Program Coordinator						
	x	Elena Austin	PhD	Assistant Professor						

D.2 Personnel updates

a. Level of Effort: NA
b. New Senior/Key Personnel: NA
c. Changes in Other Support: NA
d. New Other Significant Contributors: NA

E. IMPACT

E.1 - What is the impact on the development of human resources, if applicable?

NA

E.2 - What is the impact the Public Health Relevance and Impact? The investigator should address how the findings of the project relate beyond the immediate study to improved practices, prevention or intervention techniques, legislation, policy, or use of technology in public health.

The Pilot Program stimulates and supports new and expanded research, prevention/intervention, and education/translation activities in the area of occupational safety and health in Northwest farming, fishing and forestry. This program fosters the development of new investigators, builds partnerships and enhances collaborations in the field of occupational safety and health research.

F. CHANGES

F.1 - Changes in approach and reasons for change, including changes that have a significant impact on expenditures

With this report, we propose for NIOSH's approval and change in Program PI from Dr. Catherine Karr to Dr. Elena Austin. Likewise this role would include serving on the PNASH Center Internal Advisory Committee (See P&E Core and Biosketch following).

Updated and increased applicant guidelines for project proposals have been approved by the IAC. The program will focus on funding research projects at a higher funding rate of up to $40,000 per project and a total allocation of $180,000, with the option of applying for a smaller $5,000 supplement to fund an additional education/research translation component. This component will be for projects seeking to support the development and dissemination of project results through community partnerships. Revised eligibility criteria should expand the reach of the program.

Project evaluation guidelines have been updated as well, most notably to include more specific language around the representation of vulnerable populations and environmental justice components.

These updated guidelines were reviewed by the IAC in March and will be implemented in the next cycle of applications this spring.

F.2 - Actual or anticipated challenges or delays and actions or plans to resolve them

NA

F.3 - Significant changes to human subjects, vertebrate animals, biohazards, and/or select agents

NA

G. Special Reporting Requirements

G.1 Special Notice of Award Terms and Funding Opportunities Announcement Reporting Requirements
NA

G.2 Responsible Conduct of Research
NA

G.3 Mentor's Research Report or Sponsor Comments
NA

G.4 Human Subjects

G.4.a Does the project involve human subjects?
Yes

G.4.b Inclusion Enrollment Data
See table following this project report.

G.4.c ClinicalTrials.gov
Does this project include one or more applicable clinical trials that must be registered in ClinicalTrials.gov under FDAAA?
No

G.5 Human Subject Education Requirement

Are there personnel on this project who are newly involved in the design or conduct of human subject's research?
No

G.6 Human Embryonic Stem Cells (HESCS)

Does this project involve human embryonic stem cells (only hESC lines listed as approved in the NIH Registry may be used in NIH funded research)?
No

G.7 Vertebrate Animals

Does this project involve vertebrate animals?
No

G.8 Project/Performance Sites

G.9 Foreign Component

NA

G.10 Estimated Unobligated Balance

G.10.a Is it anticipated that an estimated unobligated balance (including prior year carryover) will be greater than 25% of the current year's total approved budget?

No

G.11 Program Income

Is program income anticipated during the next budget period?
Yes

G.12 F&A Costs

Is there a change in performance sites that will affect F&A costs?
No

I. OUTCOMES

I. Provide a concise summary of the outcomes or findings of the award, written for the general public in clear and comprehensible language, without including any proprietary, confidential information or trade secrets

Note: project outcome information will be made public in NIH RePORTER

The PNASH Center administers a Pilot Project Program (PPP) to support new initiatives in research, intervention, and translation. The goal of the PPP is to stimulate and support new and expanded research, prevention/intervention, and education/translation activities in the area of occupational safety and health in Northwest farming, forestry, and fishing. In the 2016-2021 cycle, The PPP program was administered annually with 2-3 projects funded at $25,000 per project, with increased funding in Year 6.

The program will follow the mechanism previously developed and implemented by the PNASH Center. This is a formal process that includes: 1) release of a request for proposals for Northwest investigators; 2) internal and external review and scoring of proposals; 3) notification of award or request for revision and resubmission; and 4) a record of program process and project results.

Previously funded pilot projects have allowed the Center to address emerging issues, bring in new investigators, and address needs/industries not included in other projects. Over the Center's 23 years, it has funded 56 pilot or feasibility projects, including 14 in the 2016-2021 cycle.

Projects –see https://deohs.washington.edu/pnash/research

Characterizing Determinants of Stress, Fatigue, and Injury Risk in Log Truck Drivers (2021-2022)
PI: Marissa Baker, Assistant Professor, UW Environmental and Occupational Health Sciences

Stressors of balancing childcare, work, and concerns about ambient exposures on personal well-being and work presenteeism for farmworker parents during and after the COVID-19 pandemic (2021-2022)
PI: Savannah D'Evelyn, Postdoctoral Fellow, UW Environmental and Occupational Health Sciences

Pesticide Exposures and Risk Perceptions among Male and Female Latinx Farmers in Idaho (2021-2022)
PI: Carly Hyland, Postdoctoral Research Scholar, University of Idaho College of Health Sciences

Exploring Decision making among Alaska Native Commercial Salmon Set Netters (2021-2022)
PI: Leann Fay and Jerry Dzugen, AMSEA

Sexual Harassment Prevention in Agriculture: Evaluating a Training Video and Curriculum (2019-2021)
PI: Jody Early, UW Bothell.

Smoke Monitoring for Agricultural Safety & Health (SMASH) (2019-2021)
PI: Edward Kasner, UW Department of Environmental and Occupational Health Sciences

Use of Unexpected Events and Management Requiring Conditions in the Training and Management of Loggers (2019-2021) PI: Kevin Lyons, Oregon State University

Systemic Evaluation of Exoskeletons in Reducing Musculoskeletal Disorders in Manual Timber Felling (2019-2021) PI: Jay Kim, Oregon State University

Evaluation of Wearable-Based Activity Recognition Modeling Applications for Logging Safety (2018-2020)
PI: Robert Keefe, University of Idaho Experimental Forest

Nitrate Well Water Testing in Agricultural Communities: Improving Environmental Health Communication with Health Behavior Theory (2018-2020)
PI: Elena Austin, UW Department of Environmental and Occupational Health Sciences

Northwest Safety Summit for Safety Professionals in the Logging Sector (2018-2019)
PI: John Garland, Oregon State University

An Agricultural Worker Data Repository and Interactive Visualization (2017-2018)
PI: Elena Austin, UW Department of Environmental and Occupational Health Sciences

Respiratory Health and Indoor Air Quality in Washington's Cannabis Industry (2017-2019)
PI: Christopher Simpson, UW Department of Environmental and Occupational Health Sciences

Recognizing and Reducing Risks in the Northwest Potato Industry (2017-2019)
PIs: Carly Hyland, Boise State University

Funding Priorities

The PPP places a special emphasis on supporting meritorious projects that widen PNASH's work in the industries of fishing and forestry, and projects that support early-stage investigators.

- Develop preliminary data or expertise to support new proposals,
- Adapt or evaluate proven tools or techniques for new populations, workplaces, or delivery methods,
- Evaluate the merit of new ideas, or new approaches to existing methodologies or datasets,
- Explore new directions in research, prevention/intervention, and education/translation,
- Apply their expertise to the field of agricultural safety and health, and
- Leverage emerging technologies in supporting a healthy, safe, and productive AgFF workplace.

A. COVER PAGE

Project Title: Rabinowitz - The Healthy Dairy Worker Study	
Grant Number: 5U54OH007544	**Project/Grant Period**: 09/30/2016 – 09/29/2022
Reporting Period: 09/30/2016 – 09/29/2022	**Date Submitted**: 12/28/2022
Program Director/ Principal Investigator Peter Rabinowitz, MD, MPH Email: peterr7@uw.edu Phone: 206 616-0598	**Administrative Official Information** CAROL RHODES University of Washington Office of Sponsored Programs 4333 Brooklyn Ave NE SEATTLE, WA 98105 Phone number: 206-543-4043 Email: osp@uw.edu
Change of Contact PD/PI: NA	
Human Subjects: UW IRB #42 10/01/21-09/30/22	**Vertebrate Animals:** No
hESC: No	**Inventions/Patents:** No

B. ACCOMPLISHMENTS

B.1. What are the major goals of the project?

The Healthy Dairy Worker Study
AIM 1 Compare reported health status, gut and nasal microbiome, and respiratory function in a cohort of newly hired dairy workers, as well as comparison groups of community controls and experienced workers
AIM 2 Over a two-year follow-up period, compare gut and nasal microbiome change between new workers and controls
AIM 3 Determine whether microbiome components are associated with health status or early work cessation

B.2. What did you accomplish under these goals?

Our study evaluates the impact of these factors on respiratory and gut health by measuring the nasal and gut bacteria present in the body and comparing it to respiratory function of workers. We will analyze changes in the microbiome and health status for newly hired dairy workers, existing dairy workers, and community members over a two-year period. Our goal is to determine if the quantity and type of bacteria in the microbiome of workers are related to the participant's health or leaving the job. We are currently completing analysis after 5-years of sample collection.

AIM 1 Compare reported health status, gut and nasal microbiome, and respiratory function in a cohort of newly hired dairy workers, as well as comparison groups of community controls and experienced workers.
Our sample collection ended in 2022, ending a rigorous 5-year field study of recruitment of four farms and enrollment of 53 farmworker participants for biological sampling. A manuscript entitled "A Cross Sectional Study of Respiratory and Allergy Status in Dairy Workers" has been accepted pending edits to the Journal of Agromedicine. We will look at microbiome differences and whether those are determinants of respiratory function.

We have compared IgE levels and measures of respiratory function in adult dairy workers and a sample of community controls without dairy farm contact. Our results show that rates of self-reported asthma were similar in the two groups, and if anything lower in the workers than the community. Mean levels of eNO (exhaled nitric oxide, a measure of airway inflammation) were higher in community controls. IgE levels were similar in both groups, but bovine specific IgE was only found to be elevated in dairy workers, not community controls. Multivariate analyses have shown that dairy work was significantly associated with higher FEV1/FVC. Additionally, increased bovine-IgE was significantly associated with higher FeNO.

A summary of findings to-date

- Dairy workers performed better on breathing tests and had lower levels of lung inflammation, as compared to community members. This lack of worsening may be related to their dairy farm exposure or selective survival effect.
- The study found some evidence that some dairy workers were developing an allergy to cow antigens, and that such allergy may be related to airway inflammation.

AIM 2 Over a two-year follow-up period, compare gut and nasal microbiome change between new workers and controls.
In 2021-2022, we explored the value of metagenomic analysis in a subset of study participants This exploration can be found in Pauline Trinh's dissertation entitled "From Metagenomics to Pangenomics: Characterization of Dairy Worker Microbiomes and Development of Novel Statistical Methodology" which addresses the microbiome of workers as compared to community controls, as well as the novel microbiomes. Chapters from the dissertation will be submitted for publication in peer-reviewed journals. We will continue to explore metagenomic analysis in an R21 award to biostatistics faculty, Amy Willis. Additionally, we have recently completed sample DNA extractions and sequencing and are now preparing to do the larger crossectional and longitudinal analyses, to be completed in 2022-2023

AIM 3 Determine whether microbiome components are associated with health status or early work cessation

Due to low numbers in the early years of the study of new dairy workers, we were not able to complete a full comparison of the microbiome of new workers and controls. We now have the sampling sequences for continuing analysis from all new dairy workers, and this on-going work should fill in this gap of knowledge.

In the 2022-2023 academic year, PhD Student and RA Jorge Rivera-Gonzalez will analyze data and write manuscripts on the following topics: Determine whether microbiome components are associated with health status or early work cessation; Assess the microbiome in asthmatic vs non-asthmatic study participants; Change of microbiome diversity over time.

B.3. Competitive Revisions/Administrative Supplements

The Year 6 extension, 2021-2022, was supported through an administrative supplement to PNASH.

B.4. What opportunities for training and professional development did the project provide?

This study has led to lasting relationships between WA State dairy industries and the University of Washington. This has been demonstrated through the recruitment and retention of study participants over time and periodic presentations and feedback from the dairy industry. In 2021, we will reach out to additional dairies to recruit new dairy workers and increase those relationships. The project has also provided key opportunities for professionals in training to become aware of the occupational health aspects of dairy farming.

B.5. How did you disseminate the results to communities of interest?

This past year, we returned individual results of respiratory testing to participants, and, if needed, provided a medical referral. We have also been in touch with the farm owners to give them in writing some aggregate results from our study of bovine allergy and asthma.

B.6 - What do you plan to do during the next reporting period to accomplish the goals?

We have completed sample collection in 2022 after a rigorous 5-year field study. Due to challenges recruiting new dairy workers early in the study, we were not previously able to complete a full comparison of the microbiome of new workers and controls. We now have enough samples from new dairy workers for continuing analysis and fill in this gap of knowledge.

A manuscript entitled "A Cross Sectional Study of Respiratory and Allergy Status in Dairy Workers" has been accepted pending edits to the Journal of Agromedicine. In 2022-2023, we will look at microbiome differences and whether those are determinants of respiratory function.

We will be publishing the metagenomic analysis into several papers with Dr. Trinh. Additionally, we have recently completed sample DNA extractions and sequencing and are now preparing to do the longitudinal analysis, to be completed in 2022-2023.

In the 2022-2023 academic year, PhD Student Jorge Rivera-Gonzalez will analyze data and support the development of manuscripts on the following topics:
1. Compare microbiome diversity and components between workers and controls,
2. Determine whether microbiome components are associated with health status or early work cessation,
3. Assess the microbiome in asthmatic vs non-asthmatic study participants,
4. Change of microbiome diversity over time, and
5. Determine degree of microbiome sharing between humans and animals.

And in addition to our original aims, ERC OHHAI MS student Alyssa Suarez will work on a manuscript looking at COVID illness, vaccination and antibodies in a subset of Healthy Dairy Worker participants. ERC OHHAI PhD student Hilary Weiser will also analyze differences in protective behaviors across different dairy work categories.

Based on our experience with the dairy workers, we created a training module for Infection Prevention and Control on Animal Farms. We will be adapting this for farm audits by the Washington State Dept. of Labor and Industry and for voluntary program development by the farms. .

C. PRODUCTS

C.1. Publications, conference papers, and presentations

Trinh P. From Metagenomics to Pangenomics: Characterization of Dairy Worker Microbiomes and Development of Novel Statistical Methodology. 2022 Doctoral Dissertation. Department of Environmental and Occupational Health Sciences, University of Washington, Seattle, Washington. See Abstract. ResearchWorks.

de Marcken MG. 2020. Occupational Dairy Exposure and IgE-mediated Allergic Disease in Yakima, WA. 2020 Master's Thesis. Department of Environmental and Occupational Health Sciences, University of Washington. ResearchWorks.

Carmona JT. The Healthy Dairy Worker Study: A Longitudinal Cohort Study of Dairy Workers' Respiratory Health. 2020 Master's Thesis. Department of Environmental and Occupational Health Sciences, University of Washington. ResearchWorks.

C.2. Website(s) or other Internet site(s) – include URL(s)

https://deohs.washington.edu/pnash/healthy-dairy-worker-study
https://deohs.washington.edu/cohr/farm-infection-training

C.3. Technologies or techniques

NA

C.4. Inventions, patent applications, and/or licenses

NA

C.5. Other products and resource sharing

Protocol: Healthy Dairy Worker Project Data Management and Access Plan
Infection Prevention and Control template for animal agriculture

D. PARTICIPANTS

D.1. What individuals have worked on the project? Please include calendar, academic, and summer months.

Commons ID	S/K	Name	Degrees(s)	Role	Cal	Aca	Sum	Foreign	Country	SS
rabinowitz	X	Peter Rabinowitz	MD, MPH	PI	15					
		Jose Carmona	BA, MPH	Research Coordinator	30					
		Cecilia Noedker	PhD	Staff Scientist	6					
		Pablo Palmandez	MS, MPH	Research Coordinator	50					
vramirez1		Vickie Ramirez	BA, MA	Research Coordinator	36					
		Tino Alonso		Research Staff	6					
		Eric Gabino	BA	Research Staff	12					

		Hannah Fenelon	BA, MPH	Data Analyst	.5					

D.2 Personnel updates

a. Level of Effort: NA
b. New Senior/Key Personnel: NA
c. Changes in Other Support: No changes for this period.
d. New Other Significant Contributors: NA

E. IMPACT

E.1 - What is the impact on the development of human resources, if applicable?
NA

E.2 - What is the impact the Public Health Relevance and Impact? The investigator should address how the findings of the project relate beyond the immediate study to improved practices, prevention or intervention techniques, legislation, policy, or use of technology in public health.

There is a need to determine the most effective training methods for dairy workers. Using the most effective method will result in a safer workforce and less waste of resources and time. Similarly, better understanding of healthy adaptations to the dairy work environment can help maintain a healthy workforce. The project is also advancing the concept of infection prevention and control programs on farms which has implications for health and safety staffing on farms.

F. CHANGES

F.1 - Changes in approach and reasons for change, including changes that have a significant impact on expenditures
NA

F.2 - Actual or anticipated challenges or delays and actions or plans to resolve them
The COVID pandemic seriously hampered our efforts to recruit due to restrictions of enrolling study subjects. We were later able to increase field research staffing to actively enroll more first-time dairy workers.

F.3 - Significant changes to human subjects, vertebrate animals, biohazards, and/or select agents

NA

G. Special Reporting Requirements

G.1 Special Notice of Award Terms and Funding Opportunities Announcement Reporting Requirements
NA

G.2 Responsible Conduct of Research
NA

G.3 Mentor's Research Report or Sponsor Comments
NA

G.4 Human Subjects

G.4.a Does the project involve human subjects?
Yes

G.4.b Inclusion Enrollment Data
See table following this project report.

G.4.c ClinicalTrials.gov
Does this project include one or more applicable clinical trials that must be registered in ClinicalTrials.gov under FDAAA?
No

G.5 Human Subject Education Requirement

Are there personnel on this project who are newly involved in the design or conduct of human subjects research?
No

G.6 Human Embryonic Stem Cells (HESCS)

Does this project involve human embryonic stem cells (only hESC lines listed as approved in the NIH Registry may be used in NIH funded research)?
No

G.7 Vertebrate Animals

Does this project involve vertebrate animals?
No

G.8 Project/Performance Sites

University of Washington, Seattle, WA
Washington State University, Pullman, WA

G.9 Foreign Component

NA

G.10 Estimated Unobligated Balance
G.10.a Is it anticipated that an estimated unobligated balance (including prior year carryover) will be greater than 25% of the current year's total approved budget?

No

G.11 Program Income

Is program income anticipated during the next budget period?
No

G.12 F&A Costs

Is there a change in performance sites that will affect F&A costs?
No

I. OUTCOMES

I. Provide a concise summary of the outcomes or findings of the award, written for the general public in clear and comprehensible language, without including any proprietary, confidential information or trade secrets

Note: project outcome information will be made public in NIH RePORTER

THE HEALTHY DAIRY WORKER STUDY
https://deohs.washington.edu/pnash/healthy-dairy-worker-study

Challenge
Dairy workers are commonly exposed to microbes and allergens on the job. However, little is known about whether these exposures provide health benefits or contribute to an increased risk of illness. The 'hygiene hypothesis,' suggests that exposure to microbes on farms may have immune benefits.

Project Overview
Our study evaluates the impact of these factors on respiratory and gut health by measuring the nasal and gut bacteria present in the body and comparing it to respiratory function of workers. We will analyze changes in the microbiome and health status for newly hired dairy workers, existing dairy workers, and community members over a two-year period. Our goal is to determine if the quantity and type of bacteria in the microbiome of workers are related to the participant's health or leaving the job. We are currently completing analysis after 5-years of sample collection.

Findings to Date
This project completed sample collection in 2022 and has further analysis underway.

- Dairy workers performed better on breathing tests and had an abundance of certain 'healthy' bacteria that protect against inflammation, as compared to community members. This benefit may be from the greater contact with cows.
- There appear to be differences between individuals in the amount of gut bacteria associated with inflammation.
- The study found some evidence that some dairy workers were developing an allergy to cow antigens.

Other Accomplishments

- Our sample collection ended in 2022, ending a rigorous 5-year field study of recruitment of four farms and enrollment of 53 farmworker participants for biological sampling.
- Dr. Pauline Trinh's PhD dissertation entitled "From Metagenomics to Pangenomics: Characterization of Dairy Worker Microbiomes and Development of Novel Statistical Methodology."

Resources
Partnership for Dairy Safety and Health, https://deohs.washington.edu/pnash/partnership-dairy-safety-and-health
Free, Online Training Modules for Infection Prevention and Control (IPC) on Animal Farms, https://deohs.washington.edu/cohr/farm-infection-training

"As the owner of a dairy farm, I am interested in the health of workers and feel that your research could shed light on novel methods of maintaining worker health in this work environment where microbial exposure is unavoidable."
- WA Dairy Owner

"Este studio me ha dado la oportunidad de placticar con me hija y esposa sobre como puedo mejorar mi salud cuando trabajo con las vacas."

"This study has given me the opportunity to talk with my daughter and wife about how I can improve my health when I work with cows."

-WA Dairy Worker Participant

View Burden Statement

PHS Inclusion Enrollment Report

This report format should NOT be used for collecting data from study participants.

OMB Number: 0925-0001
Expiration Date: 3/31/2020

***Study Title (must be unique):** The Healthy Dairy Worker Study

* Delayed Onset Study? ☐ Yes ☒ No

If study is not delayed onset, the following selections are required:

Enrollment Type ☐ Planned ☒ Cumulative (Actual)

Using an Existing Dataset or Resource ☐ Yes ☒ No

Enrollment Location ☒ Domestic ☐ Foreign

Clinical Trial ☐ Yes ☒ No **NIH-Defined Phase III Clinical Trial** ☐ Yes ☒ No

Comments: UW IRB #42

Racial Categories	Ethnic Categories									
	Not Hispanic or Latino			Hispanic or Latino			Unknown/Not Reported Ethnicity			Total
	Female	Male	Unknown/ Not Reported	Female	Male	Unknown/ Not Reported	Female	Male	Unknown/ Not Reported	
American Indian/ Alaska Native	0	0	0	0	0	0	0	0	0	0
Asian	0	0	0	0	0	0	0	0	0	0
Native Hawaiian or Other Pacific Islander	0	0	0	0	0	0	0	0	0	0
Black or African American	1	3	0	1	6	0	0	0	1	12
White	1	11	0	3	58	2	0	0	0	75
More than One Race	0	0	0	0	0	0	0	0	0	0
Unknown or Not Reported	0	0	0	0	0	0	0	4	7	11
Total	2	14	0	4	64	2	0	4	8	98

Report 1 of 1

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A. COVER PAGE

Project Title: Kasner - Prevention of Occupational Exposure to Pesticide Drift	
Grant Number: 5U54OH007544	**Project/Grant Period**: 09/30/2016 – 09/29/2022
Reporting Period: 09/30/2016 – 09/29/2022	**Date Submitted**: 12/28/2022
Program Director/ Principal Investigator EDWARD KASNER , PHD, MPH Phone number: 206 616-4225 Email: ejkasner@uw.edu	**Administrative Official Information** CAROL RHODES University of Washington Office of Sponsored Programs 4333 Brooklyn Ave NE SEATTLE, WA 98105 Phone number: 206-543-4043 Email: osp@uw.edu
Change of Contact PD/PI: NA	
Human Subjects: NA	**Vertebrate Animals:** No
hESC: No	**Inventions/Patents:** No

B. ACCOMPLISHMENTS

B.1. What are the major goals of the project?

Prevention of Occupational Exposure to Pesticide Drift
AIM 1 Determine the probability of drift events due to environmental conditions during spraying
AIM 2 Conduct validation studies of our Drift Determinants model
AIM 3 Translate study findings into exposure prevention tools for agricultural producers and workers

B.2. What did you accomplish under these goals?

Our project attempted to understand the mechanisms of pesticide drift exposure among agricultural workers and prevent such exposures in the future. To accomplish this, we worked with the Washington State Department of Health (DOH) and Washington State University (WSU) to determine the probability of drift events due to environmental conditions during spraying, develop a predictive model, and conduct field studies to validate our model. Our drift determinants model was designed to assist orchardists in assessing risks for drift-prone conditions. Findings from our field studies and model are being incorporated into farmworker pesticide safety training. A short summary of progress is provided by each aim below.

AIM 1 Determine the probability of drift events due to environmental conditions during spraying
We estimated weather conditions during documented drift events in Washington State from 2000 to 2015 and built a 'drift determinants' model by conducting a case-crossover study of changing wind conditions on drift event days vs. non-drift event days. To characterize wind speed and direction at the time of the events, we linked illness data to meteorological data from a network of 171 state weather stations. Most drift events occurred in tree fruit (151/252 = 60%). Ground spraying and aerial applications accounted for 68% and 23% of events, respectively; 69% of confirmed cases were workers, and 31% were bystanders. Complete applicator spray records were available for only 57 drift events (23%). Average applicator-reported wind speeds were about 2 miles/hour lower than corresponding speeds from the nearest weather station values. Approximately 56% of drift events were associated with wind speed increases that occurred after the spray start time.

AIM 2 Conduct validation studies of our Drift Determinants model
We investigated the impact of distance and terrain on AgWeatherNet-based meteorological measurements at representative sites in the Yakima Valley and modeled wind ramping during field sampling of pesticide drift in 2018 and 2019. For this aim, we collaborated with WSU Investigators Khot and Hoheisel, who conducted orchard spray trials in the near Benton City, WA with funding from the U.S. Forest Service, U.S. Department of Agriculture, and the Washington State Tree Fruit Research Commission. Their project, "Data to Model Apple Airblast Spraying Drift Exposure Levels" has generated data to validate a drift model for estimating human exposure from airblast spraying during dormant and full-canopy tree growth stage. A PNASH graduate student, Yoni Rodriguez, joined this project team and developed a wind ramping forecast model that was integrated into experimental wind alerts for a 'smart orchard' integrated with AgWeatherNet stations. Our interdisciplinary team has prepared a manuscript draft on this work,"Comparing Tracers: Concurrent Applications of Micronutrient and Fluorescent Dyes in Airborne Drift of Orchard Airblast Spray Trials."

AIM 3 Translate study findings into exposure prevention tools for agricultural producers and workers
We are currently producing new training material for 'Drift Management Best Practices' courses, creating a user-friendly method for WA DOH investigators to integrate weather conditions into drift event documentation, and developing a system to alert pesticide applicators about drift-prone weather conditions. We anticipate the incorporation of a novel metric known as wind ramping – or the magnitude, duration, and intensity of wind changes – into decision making around pesticide application and as a training tool used by pesticide safety trainers in the Pacific Northwest. Aerial UAV footage was captured of our November and December 2018 spray trials, which will also be used in these trainings.

Additional translational activities included: 1) creating of a video tutorial for WA DOH investigators to link weather data to pesticide illness data and also integrated spatial features from GoogleEarthPro, which is now being used at WA DOH; 2) establishing proof of concept for low-cost, on-site meteorological stations for applicators to monitor wind conditions throughout a spray period--instead of using a hand-held anemometer only at the beginning of a spray period, as is currently required by state regulationsor the nearest AgWeatherNet (AWN) station, as we did in Aim 1;3) coordinating with the Practical Solutions for Pesticide Safety project and other PNASH pesticide education activities to share infographic communications on our results; and 4) disseminating project stories through the PNASH website, and PNASH's pesticide safety partnerships, media outlets and our new, and a new on-demand online course.

Related to this project, Investigator Kasner served on two different pesticide application workgroups established by the Washington State Legislature. The first workgroup was the Aerial Application of Herbicides in Forestry Working Group, which met on six different occasions (Sept-Dec 2019) throughout Washington to review best practices of aerial application of herbicides on forestland across the state. That workgroup finalized its commitments and submitted a report to the Governor's office at the end of 2019. The second workgroup, the Pesticide Application Safety Committee, met on three occasions (Oct 2020, March 2020, August 2022) in Olympia to develop recommendations for improving the safety of pesticide application and will continue to meet through 2025.

B.3. Competitive Revisions/Administrative Supplements

The Year 6 extension, 2021-2022, was supported through an administrative supplement to PNASH.

B.4. What opportunities for training and professional development did the project provide?

Dr. Edward Kasner is an early career investigator, under the mentorship of Dr. Richard Fenske, Dr. Michael Yost, and Dr. June Spector.

Training:

- Modules for WSDA Technical Service and Education ProgramWSU Pesticide Education Program: On Farm Assistance, and Spray Drift Surveillance at Pesticide Technical Assistance and Education | Washington State Department of Agriculture
- Pesticide Safety Solutions PNASH Online On-Demand Courses | Pacific Northwest Agricultural Safety and Health Center (washington.edu)

B.5. How did you disseminate the results to communities of interest?

Dissemination of results is ongoing and in coordination with PNASH's other pesticide project teams to co-present results regionally and to share findings through our pesticide safety partnerships and media outlets.

Integrated experimental wind alerts into a 'smart orchard' setting, including AgWeatherNet. We connected with several new agricultural technology startup companies in the tree fruit sector (e.g. Thingy, LLC; Innov8; Harvust) that are using sensors and mobile technology networks to inform precision agriculture and decision support.
Thingy: https://thingy.us/.
Innov8: https://www.innov8.ag/.
Harvust: https://www.harvust.com/.

Ongoing member of Washington's Pesticide Application Safety Committee (PASCO), advisor for the Agricultural Leadership Program, and advisor for the Washington Environmental Health Disparities Interactive Map (https://doh.wa.gov/data-and-statistical-reports/washington-tracking-network-wtn/washington-environmental-health-disparities-map) that is adding a pesticide use layer

B.6 - What do you plan to do during the next reporting period to accomplish the goals?

This project has closed. Our results provide actionable information about drift events in terms of time, space, and wind variability. Messages about exposure prevention can be delivered to managers, supervisors, and workers.

We have drafted a second paper on the utility of on-site meteorological stations for applicators to monitor wind conditions throughout a spray period, instead of using a hand-held anemometer only at the beginning of a spray period, as is currently required

C. PRODUCTS

C.1. Publications, conference papers, and presentations

Kasner EJ. On Preventing Farmworker Exposure to Pesticide Drift in Washington Orchards. 2017 Doctoral Dissertation. Department of Environmental and Occupational Health Sciences, University of Washington, Seattle, Washington. See Abstract. ResearchWorks.

Prado JB, Mulay PR, Kasner EJ, Bojes HK, Calvert GM. Acute Pesticide-Related Illness Among Farmworkers: Barriers to Reporting to Public Health Authorities. Journal of Agromedicine. 2017;22(4):395-405. doi: 10.1080/1059924X.2017.1353936. PMID: 28762882; PMCID: PMC5846675.

Kasner EJ, Fenske RA, Hoheisel GA, Galvin K, Blanco MN, Seto EYW, Yost MG. Spray Drift from a Conventional Axial Fan Airblast Sprayer in a Modern Orchard Work Environment. Annals of Work Exposures and Health. 2018 Nov 12;62(9):1134-1146. doi: 10.1093/annweh/wxy082. PMID: 30346469; PMCID: PMC7104543.

Kasner EJ, Fenske RA, Hoheisel GA, Galvin K, Blanco MN, Seto EYW, Yost MG. Spray Drift from Three Airblast Sprayer Technologies in a Modern Orchard Work Environment. Annals of Work Exposures and Health. 2020 Jan 1;64(1):25-37. doi: 10.1093/annweh/wxz080. PMID: 31786605; PMCID: PMC7175243.

Kasner EJ, Prado JB, Yost MG, Fenske RA. Examining the Role of Wind in Human Illness Due to Pesticide Drift in Washington State, 2000-2015. Environmental Health. 2021 Mar 15;20(1):26. doi: 10.1186/s12940-021-00693-3. PMID: 33722241; PMCID: PMC7958705.

Rodriguez Y. Exploring Wind Ramping as a Determinant of Pesticide Drift. 2022 Master's Thesis. Department of Environmental and Occupational Health Sciences, University of Washington, Seattle, Washington. ResearchWorks.

C.2. Website(s) or other Internet site(s) – include URL(s)

https://deohs.washington.edu/pnash/prevention-occupational-exposure-pesticide-drift

C.3. Technologies or techniques

NA

C.4. Inventions, patent applications, and/or licenses

NA

C.5. Other products and resource sharing

Protocol: Pesticide Drift Project Data Management and Access Plan

D. PARTICIPANTS

D.1. What individuals have worked on the project? Please include calendar, academic, and summer months.

Commons ID	S/K	Name	Degrees(s)	Role	Cal	Aca	Sum	Foreign	Country	SS
	x	Edward Kasner	BA,MPH, PhD	Project PI	28.8					NA
	x	Michael Yost	BS,MS, PhD	Co-Investigator	.72					NA
	x	Richard Fenske	AB,MPH, MA,MA,PHD	Co-Investigator	3.0					NA
	x	Kit Galvin	BA, MS, CIH	Industrial Hygienist	1.2					NA

		Pablo Palmandez	BS, MS	Research Coordinator	1.8					NA
		Grad RA	MS			3				

D.2 Personnel updates

a. Level of Effort: NA

b. New Senior/Key Personnel: NA

c. Changes in Other Support: NA

d. New Other Significant Contributors: NA

E. IMPACT

E.1 - What is the impact on the development of human resources, if applicable?

NA

E.2 - What is the impact the Public Health Relevance and Impact? The investigator should address how the findings of the project relate beyond the immediate study to improved practices, prevention or intervention techniques, legislation, policy, or use of technology in public health.

-Linking epidemiological data about pesticide drift illnesses and historical weather data over multiple years is a new approach to the study of drift.
-Providing actionable information about drift events in terms of time, space, and wind variability.
-Messaging about application best practices and exposure prevention could be delivered to managers, crew supervisors, and workers shortly before spraying season.
-Identifying drift-prone periods of March–July, which increases demands on state investigators, is an appropriate time to boost capacity for public health surveillance. Resources could focus on those counties with the highest number of drift events.
-Incorporating new training materials to improve the practice of pesticide application and for better documentation of spray drift events. Recommending that applicators continue to be given clear instructions and standardized methods to record such information.
-Recommending that the state sponsor a pilot program to evaluate the most practical means of providing applicators with real-time meteorological information.
-Ongoing member of the Washington's Pesticide Application Safety Committee (PASCO).

F. CHANGES

F.1 - Changes in approach and reasons for change, including changes that have a significant impact on expenditures

NA

F.2 - Actual or anticipated challenges or delays and actions or plans to resolve them

NA

F.3 - Significant changes to human subjects, vertebrate animals, biohazards, and/or select agents

No significant changes.

G. Special Reporting Requirements

G.1 Special Notice of Award Terms and Funding Opportunities Announcement Reporting Requirements
NA

G.2 Responsible Conduct of Research
NA

G.3 Mentor's Research Report or Sponsor Comments
NA

G.4 Human Subjects

G.4.a Does the project involve human subjects?
Yes

G.4.b Inclusion Enrollment Data
See table following this project report.

G.4.c ClinicalTrials.gov
Does this project include one or more applicable clinical trials that must be registered in ClinicalTrials.gov under FDAAA?
No

G.5 Human Subject Education Requirement

Are there personnel on this project who are newly involved in the design or conduct of human subject's research?
No

G.6 Human Embryonic Stem Cells (HESCS)

Does this project involve human embryonic stem cells (only hESC lines listed as approved in the NIH Registry may be used in NIH funded research)?
No

G.7 Vertebrate Animals

Does this project involve vertebrate animals?
No

G.8 Project/Performance Sites

University of Washington, Seattle, WA

G.9 Foreign Component

NA

G.10 Estimated Unobligated Balance

G.10.a Is it anticipated that an estimated unobligated balance (including prior year carryover) will be greater than 25% of the current year's total approved budget?
No

G.11 Program Income

Is program income anticipated during the next budget period?
Yes

G.12 F&A Costs

Is there a change in performance sites that will affect F&A costs?
No

I. OUTCOMES

I. Provide a concise summary of the outcomes or findings of the award, written for the general public in clear and comprehensible language, without including any proprietary, confidential information or trade secrets

Note: project outcome information will be made public in NIH RePORTER

PREVENTION OF OCCUPATIONAL EXPOSURE TO PESTICIDE DRIFT
https://deohs.washington.edu/pnash/prevention-occupational-exposure-pesticide-drift

Challenge

Pesticide drift is a long-standing issue in the Pacific Northwest, especially for the tree fruit industry and workforce. Studies have shown that at least 60% of drift events were linked to wind speed or direction changes. Understanding the role winds play in pesticide drift can prevent unintended exposure for workers and nearby communities.

Project Overview

This project aimed to reduce pesticide drift exposure. We sought to determine how factors such as wind speed and direction affected the likelihood of drift events. Our goal was to develop a statistical model and conduct field studies to validate this model for use in forecasting. This model has been developed to assist orchardists with assessing risks related to weather conditions when drift is most likely to occur.

Findings to Date

- Linked 2000-2015 data for pesticide drift event and weather data in rural Washington:
  - Most pesticide drift events occurred in tree fruit (151/252 = 60%)
  - Drift events involved two main types of pesticide application: ground spraying (68%) and aerial spraying (23%)
  - Cases of human illness included 69% workers and 31% bystanders
  - Significant wind speed increases or direction changes during applications were found in 56% (32/57) of confirmed drift events where applicator spray records were available
  - Applicator-recorded wind speed was 2 mph lower, on average, than the wind speed from the nearest weather station
- Compared to conventional airblast sprayers, tower sprayers produced less pesticide drift and lower worker exposure.
- An in-depth analysis of five weather stations in the Lower Yakima Valley demonstrated that wind conditions can vary greatly in a small region and that wind can reliably be forecasted up to 6 hours in advance.

Other Accomplishments

- Established a new approach to study pesticide drift using epidemiological data about pesticide drift illnesses and historical weather data.
- Supported Yoni Rodriguez as he completed his Master of Science thesis in 2022: "Exploring Wind Ramping as a Determinant of Pesticide Drift."
- Recommended that drift prevention resources and pesticide illness monitoring be increased in drift-prone regions during March–July. Washington State Department of Health staff co-developed new methos for linking weather data to pesticide illness data and integrating spatial features from GoogleEarthPro into epidemiological investigations. New standard operating procedures are being developed.
- Integrated experimental wind alerts into a 'smart orchard' setting connected to AgWeatherNet. Additionally, we connected with several new agricultural technology startup companies in the tree fruit sector (e.g. Thingy, LLC; Innov8; Harvust) that are using sensors and mobile technology networks to inform precision agriculture and decision support.
- Developed new training content and recommendations for pesticide safety led by the Washington State Department of Agriculture and Washington State University.
- Ongoing member of the Washington's Pesticide Application Safety Committee (PASCO).

Training

Integrated modules into WSDA Technical Service and Education Program and WSU Pesticide Education Program: On Farm Assistance, and Spray Drift Surveillance at Pesticide Technical Assistance and Education, https://agr.wa.gov/services/education-and-training/pesticide-technical-assistance-and-education

Pesticide Safety Solutions PNASH Online On-Demand Courses, https://deohs.washington.edu/pnash/online-learning

"The tree fruit industry is migrating to low-drift technology. The benefit to growers is better crop protection, fewer culls, [and]... different regulations that recognize better practices."
- Gwen Hoheisel, WSU Research & Extension

View Burden Statement

PHS Inclusion Enrollment Report

This report format should NOT be used for collecting data from study participants.

OMB Number: 0925-0001
Expiration Date: 3/31/2020

***Study Title (must be unique):** Kasner - Prevention of Occupational Exposure to Pesticide Drift

* Delayed Onset Study? ☐ Yes ☒ No

If study is not delayed onset, the following selections are required:

Enrollment Type ☐ Planned ☒ Cumulative (Actual)

Using an Existing Dataset or Resource ☒ Yes ☐ No

Enrollment Location ☒ Domestic ☐ Foreign

Clinical Trial ☐ Yes ☒ No **NIH-Defined Phase III Clinical Trial** ☐ Yes ☒ No

Comments: IRB NA. Data sharing agreement of Washington State Dept of Health

Racial Categories	Ethnic Categories									
	Not Hispanic or Latino			Hispanic or Latino			Unknown/Not Reported Ethnicity			Total
	Female	Male	Unknown/ Not Reported	Female	Male	Unknown/ Not Reported	Female	Male	Unknown/ Not Reported	
American Indian/ Alaska Native	0	0	0	0	0	0	0	0	0	0
Asian	0	0	0	0	0	0	0	0	0	0
Native Hawaiian or Other Pacific Islander	0	0	0	0	0	0	0	0	0	0
Black or African American	0	0	0	0	0	0	0	0	0	0
White	0	0	0	0	0	0	0	0	0	0
More than One Race	0	0	0	0	0	0	0	0	0	0
Unknown or Not Reported	0	0	0	0	0	0	0	0	690	690
Total	0	0	0	0	0	0	0	0	690	690

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A. COVER PAGE

Project Title: Spector – A Multi-Level Approach to Heat-Related Illness Prevention in Agricultural Workers	
Grant Number: 5U54OH007544	**Project/Grant Period**: 09/30/2016 – 09/29/2022
Reporting Period: 09/30/2016 – 09/29/2022	**Date Submitted**: 12/28/2022
Program Director/ Principal Investigator JUNE SPECTOR, MD, MPH Phone number: 732-322-6894 Email: spectj@uw.edu	**Administrative Official Information** CAROL RHODES University of Washington Office of Sponsored Programs 4333 Brooklyn Ave NE SEATTLE, WA 98105 Phone number: 206-543-4043 Email: osp@uw.edu
Change of Contact PD/PI: NA	
Human Subjects: UW IRB #238, 10/01/21-09/30/22	**Vertebrate Animals:** No
hESC: No	**Inventions/Patents:** No

B. ACCOMPLISHMENTS

B.1. What are the major goals of the project?

A Multi-Level Approach to Heat Related Illness Prevention in Agricultural Workers

AIM 1 Develop an HRI prevention intervention approach that addresses individual, workplace, and community factors, using an establish participatory Expert Working Group Model

AIM 2 Assess the effect of the intervention on occupational heat strain and HRI symptoms in a parallel, comparison, group intervention study in WA summer tree fruit workers

AIM 3 Assess whether the association between workplace heat stress and occupational heat strain/HRI symptoms is modified by hot housing conditions using a longitudinal observation study design in WA summer tree fruit workers

B.2. What did you accomplish under these goals?

AIM 1 Develop an HRI prevention intervention approach that addresses individual, workplace, and community factors, using an establish participatory Expert Working Group Model

This project is developed and evaluated a multi-level approach to prevent heat illness by providing training tools and resources for employers, supervisors, and workers. The Heat Education & Awareness Tools (HEAT) toolkit was developed in collaboration with agricultural workers, growers, communities, educators, and other stakeholders. Field studies were conducted with workers with multiple farm partners, assessing the HEAT intervention and work, environmental, and housing conditions. Our research recorded workers' heat exposure, tasks, signs of heat illness symptoms and biometrics. Also studied in real-life conditions is the possible association between heat strain during the workday and hot housing conditions

Using PNASH's established Expert Working Group (EWG) model, we developed and evaluated Spanish/English participatory train-the-trainer (ttt) heat education that meets the requirements of the WA heat rule, which is currently being revised. The training materials featured a facilitator's guide, interactive educational materials, and worksite posters and underwent beta testing, including with promotorxs & workers.

Results from a pre/post knowledge assessment of 83 workers showed that our HEAT training:

- Improved knowledge scores 4x more than those without the HEAT training.
- Improved most in the areas of risk factors and treatments.

AIM 2 Assess the effect of the intervention on occupational heat strain and HRI symptoms in a parallel, comparison, group intervention study in WA summer tree fruit workers

In 2019, we conducted a crew-randomized field study with four larger and small WA tree fruit and vineyard growers and 83 workers, including H2-A workers, to determine whether workers who received our heat education ('intervention group') had less HRI knowledge, signs, and symptoms than those that were offered other trainings ('usual practice group'). We recorded information about baseline demographics and workers' tasks and knowledge (0-11 scale), signs and symptoms of HRI, and ambient conditions at baseline, directly after education in the intervention group, and at the end of the summer season (~3 months). We developed methods using expert review and existing guidelines to estimate exertion level categories from agricultural crop/task data.

Results showed:

- Heat strain. We examined the association between intervention assignment and heat strain, adjusting for covariates such as Heat Index and certain participant characteristics. Heat strain was estimated by using an algorithm to compute estimated core body temperature using initial body temperature and continuous heart rate data. Our physiological measures for heat strain (heart rate and core body temperature) showed greater heat strain with high effort and lower heat strain with older age.
- HRI symptoms. We examined the association between intervention assignment and weekly self-reported symptoms, adjusting for covariates such as Heat Index and certain participant characteristics. Results from participants self-reporting heat illness symptoms found associations with higher heat exposure, 10+ years agricultural work, not being an H-2A guest worker, and walking > 3 min to get to the toilet at work.

In addition, in 2022 we refined heat exposure assessment protocols and conducted a field study on heat exposure in different crops and shade conditions in central Washington state.

AIM 3 Assess whether the association between workplace heat stress and occupational heat strain/HRI symptoms is modified by hot housing conditions using a longitudinal observation study design in WA summer tree fruit workers

We initially characterized farmworker housing types and heat exposure in WA farmworker housing. Our 2019 survey of 83 farmworkers in Central WA and 2018 survey of 348 farmworkers in Skagit/Whatcom Counties, WA identified:

- The most common types of farmworker housing are dormitory or barracks (often employer sponsored), apartment or duplex, single family homes, and mobile homes/trailers. In the 2019 study, 21% of respondents reported using fans, and 62% (primarily H2-A workers) reported using some type of air conditioning (AC), though window AC units may not provide sufficient cooling.

We are currently evaluating the relationship between ambient conditions during sleep in farmworker housing and sleep duration, and whether hot housing conditions may modify the effect of heat strain when working. As part of this research, activity monitor (sleep) data have been cleaned, the relationship between measured and self-reported sleep duration described, and preliminary analyses conducted.

B.3. Competitive Revisions/Administrative Supplements

The Year 6 extension, 2021-2022, was supported through an administrative supplement to PNASH.

B.4. What opportunities for training and professional development did the project provide?

Student training is central to our work and impact. For the 2016-22 PNASH heat project alone, we engaged and trained four undergraduate students in partnership with the NIH-funded Supporting Undergraduate Research Experiences in Environmental Health (SURE-EH) program for underrepresented students, one master's student, one current PhD student, and two postdoctoral scholars, including postdoctoral Investigator Dr. Flunker.

B.5. How did you disseminate the results to communities of interest?

Dissemination activities for the projectwere conducted in collaboration with the PNASH Center Outreach Core. Primary audiences for this project are employers, workers, promotorx and HRI researchers. Our dissemination and evaluation approach piloted strategies in summer 2020 and has had continued e-media campaigns in 2021 and 2022 with employers and promotorxs. Current activities to expand this reach nation-wideinclude a series of live webinar presentations, asynchronous online courses, and a nation-wide summer HEAT information campaign with partnership with key organizations and their respective media channels.

B.6 - What do you plan to do during the next reporting period to accomplish the goals?

This project cycle has closed, yet we will have continued activities to meet our research and outreach goals. We are currently evaluating the relationship between ambient conditions during sleep in farmworker housing and sleep duration, and whether hot housing conditions may modify the effect of heat strain when working.

For our 2022 summer field work on shade, crops, and heat exposure, we are in the process of analyzing these data to inform best practices. This coming year we will be producing peer-reviewed manuscripts, infographics, and accessible materials in English and Spanish describing these study findings.

Our research team continues to provide technical input during recent Washington and Oregon rulemaking public comment periods. Also, we continue to work with PNASH's Outreach Core to disseminate information on heat illness prevention, results of analyses, and the promotion of the HEAT Toolkit. Priorities for our next step dissemination are finding ways to engage trainers and small farms and expanding our reach to other States. Future research is needed in developing evidence-based best practices for acclimatization and optimal sleeping patterns in group housing.

C. PRODUCTS

C.1. Publications, conference papers, and presentations

Chavez Santos E, Spector JT, Egbert J, Krenz J, Sampson PD, Palmández P, Torres E, Blancas M, Carmona J, Jung J, Flunker JC. The Effect of the Participatory Heat Education and Awareness Tools (HEAT) Intervention on Agricultural Worker Physiological Heat Strain: Results from a Parallel, Comparison, Group Randomized Study. BMC Public Health. 2022 Sep 15;22(1):1746. doi: 10.1186/s12889-022-14144-2. PMID: 36104813; PMCID: PMC9476265.

Egbert J, Krenz J, Sampson PD, Jung J, Calkins M, Zhang K, Palmández P, Faestel P, Spector JT. Accuracy of an Estimated Core Temperature Algorithm for Agricultural Workers. Archives of Environmental & Occupational Health. 2022;77(10):809-818. doi: 10.1080/19338244.2022.2033672. Epub 2022 Feb 3. PMID: 35114899; PMCID: PMC9346099.

Flunker JC, Zuidema C, Jung J, Kasner E, Cohen M, Seto E, Austin E, Spector JT. Potential Impacts of Different Occupational Outdoor Heat Exposure Thresholds among Washington State Crop and Construction Workers and Implications for Other Jurisdictions. International Journal of Environmental Research and Public Health. 2022 Sep 14;19(18):11583. doi: 10.3390/ijerph191811583. PMID: 36141863; PMCID: PMC9517246.

Krenz J, Santos EC, Torres E, Palmández P, Carmona J, Blancas M, Marquez D, Sampson P, Spector JT. The Multi-level Heat Education and Awareness Tools [HEAT] Intervention Study for Farmworkers: Rationale and Methods. Contemporary Clinical Trials Communications. 2021 Jun 8;22:100795. doi: 10.1016/j.conctc.2021.100795. PMID: 34169175; PMCID: PMC8209069.

Kuras ER, Richardson MB, Calkins MM, Ebi KL, Hess JJ, Kintziger KW, Jagger MA, Middel A, Scott AA, Spector JT, Uejio CK, Vanos JK, Zaitchik BF, Gohlke JM, Hondula DM. Opportunities and Challenges for Personal Heat Exposure Research. Environmental Health Perspectives. 2017 Aug 1;125(8):085001. doi: 10.1289/EHP556. PMID: 28796630; PMCID: PMC5783663.

Marquez D, Krenz JE, Chavez Santos É, Torres E, Palmández P, Sampson PD, Blancas M, Carmona J, Spector JT. The Effect of Participatory Heat Education on Agricultural Worker Knowledge. Journal of Agromedicine. 2022 Apr 17:1-12. doi: 10.1080/1059924X.2022.2058667. Epub ahead of print. PMID: 35345983; PMCID: PMC9573936.

Quiller G, Krenz J, Ebi K, Hess JJ, Fenske RA, Sampson PD, Pan M, Spector JT. Heat Exposure and Productivity in Orchards: Implications for Climate Change Research. Archives of Environmental & Occupational Health. 2017 Nov 2;72(6):313-316. doi: 10.1080/19338244.2017.1288077. Epub 2017 Jan 31. PMID: 28139172; PMCID: PMC5562533.

Quiller G. Heat Stress, Heat Strain, and Productivity in Washington State Tree Fruit Harvesters. 2017 Master's Thesis. Department of Environmental and Occupational Health Sciences, University of Washington, Seattle, Washington. ResearchWorks.

Spector JT, Masuda YJ, Wolff NH, Calkins M, Seixas N. Heat Exposure and Occupational Injuries: Review of the Literature and Implications. Current Environmental Health Reports. 2019 Dec;6(4):286-296. doi: 10.1007/s40572-019-00250-8. PMID: 31520291; PMCID: PMC6923532.

Tigchelaar M, Battisti DS, Spector JT. Work Adaptations Insufficient to Address Growing Heat Risk for U.S. Agricultural Workers. Environmental Research Letters. 2020 Sep;15(9):094035. doi: 10.1088/1748-9326/ab86f4. Epub 2020 Aug 25. PMID: 33133229; PMCID: PMC7594196.

C.2. Website(s) or other Internet site(s) – include URL(s)

https://deohs.washington.edu/pnash/multi-level-approach-heat-related-illness-prevention-agricultural-workers

https://deohs.washington.edu/pnash/heat-toolkit

C.3. Technologies or techniques

NA

C.4. Inventions, patent applications, and/or licenses

NA

C.5. Other products and resource sharing

- Protocol: Heat Related Illness Project Data Management and Access Plan
- The heat team has responded to community and stakeholder's requests for heat awareness information. Over 600 professionals trained in 6 courses (some in conjunction with AgriSafe, AIHA, NWCOSH, Harry Bridges Center).
- Produced a new radio program with Radio KDNA in Spanish on Heat and Smoke Symptoms with Dr. June Spector as the guest speaker.
- Integrated the HEAT into 4 Washington state grower information systems: AWNFarm WSU AgWeatherNet (8,850 farmers) and Harvust (6,342 farmers).
- Developed Heat-Related Illness eLearning course in conjunction with University of Washington Continuing Education Program.
- Since 2021, launched the Be Heat Smart campaign in collaboration with the WA State Department of Labor and Industries, building on our ongoing campaigns and national partners. In 2021, across all platforms, the campaign resulted in 31,118 impressions and 973 engagements.

D. PARTICIPANTS

D.1. What individuals have worked on the project? Please include calendar, academic, and summer months.

Commons ID	S/K	Name	Degrees(s)	Role	Cal	Aca	Sum	Foreign	Country	SS
spectj	x	June Spector	MPH,MD, AB	Project PI	12					
jkrenz		Jen Krenz	BA, MS, MPH	Research Coorinator	18					
		Pablo Palmandez	MS	Research Coordinator	10					
		Maria Blancas	PhD	Research Coordinator	6					
		Grad Student				4.5				

D.2 Personnel updates

a. Level of Effort: NA

b. New Senior/Key Personnel: NA

c. Changes in Other Support:

NA

d. New Other Significant Contributors: NA

E. IMPACT

E.1 - What is the impact on the development of human resources, if applicable?

The Heat Education & Awareness Tools (HEAT) program addresses risk factors for agricultural workers at the individual, workplace, and community levels. The HEAT approach includes a heat awareness mobile application for supervisors and participatory educational materials for workers.

E.2 - What is the impact the Public Health Relevance and Impact? The investigator should address how the findings of the project relate beyond the immediate study to improved practices, prevention or intervention techniques, legislation, policy, or use of technology in public health.

This participatory intervention project developed and evaluated an approach to heat-related illness (HRI) prevention for agricultural workers that addresses HRI risk factors at individual, workplace, and community levels. The results and products from this project are expected to lead to more effective prevention of occupational HRI in at-risk workers in a changing climate.

F. CHANGES

F.1 - Changes in approach and reasons for change, including changes that have a significant impact on expenditures

Due to the onset of the Coronavirus pandemic, we were unable to conduct our planned fieldwork during the summer of 2020, which had aimed to recruit a similar number of participants as 2019. After a reassessment of our current data, we concluded we had sufficient power to test our original hypotheses with the data collected in 2019.

F.2 - Actual or anticipated challenges or delays and actions or plans to resolve them

Currently there are no anticipated further delays. All programs and projects are on track for completion of original aims with the supplemental Year 6.

F.3 - Significant changes to human subjects, vertebrate animals, biohazards, and/or select agents

No significant changes.

G. Special Reporting Requirements

G.1 Special Notice of Award Terms and Funding Opportunities Announcement Reporting Requirements
NA

G.2 Responsible Conduct of Research
NA

G.3 Mentor's Research Report or Sponsor Comments
NA

G.4 Human Subjects

G.4.a Does the project involve human subjects?
Yes

G.4.b Inclusion Enrollment Data
See table following this project report.

G.4.c ClinicalTrials.gov
Does this project include one or more applicable clinical trials that must be registered in ClinicalTrials.gov under FDAAA?
No

G.5 Human Subject Education Requirement

Are there personnel on this project who are newly involved in the design or conduct of human subject's research?
No

G.6 Human Embryonic Stem Cells (HESCS)

Does this project involve human embryonic stem cells (only hESC lines listed as approved in the NIH Registry may be used in NIH funded research)?
No

G.7 Vertebrate Animals

Does this project involve vertebrate animals?
No

G.8 Project/Performance Sites
University of Washington, Seattle, WA
Washington State University, Prosser, WA

G.9 Foreign Component

NA

G.10 Estimated Unobligated Balance

G.10.a Is it anticipated that an estimated unobligated balance (including prior year carryover) will be greater than 25% of the current year's total approved budget?

No

G.11 Program Income

Is program income anticipated during the next budget period?
Yes

G.12 F&A Costs

Is there a change in performance sites that will affect F&A costs?
No

I. OUTCOMES

I. Provide a concise summary of the outcomes or findings of the award, written for the general public in clear and comprehensible language, without including any proprietary, confidential information or trade secrets

Note: project outcome information will be made public in NIH RePORTER

A MULTI-LEVEL APPROACH TO HEAT-RELATED ILLNESS PREVENTION FOR AGRICULTURAL WORKERS
https://deohs.washington.edu/pnash/multi-level-approach-heat-related-illness-prevention-agricultural workers

Challenge

Heat risks are preventable, yet are the cause of injury, illness, and death, particularly affecting outdoor workers. Future heat events are projected to be more frequent and occur for longer periods of time, and agricultural communities are looking for solutions. Few studies have examined approaches to heat illness that involve combined solutions for individuals, workplaces, and communities.

Project Overview

This project developed and evaluated a multi-level approach to prevent heat illness by providing training tools and resources for employers, supervisors, and workers. The Heat Education & Awareness Tools (HEAT) toolkit was produced in collaboration with agricultural workers, growers, communities, educators, and other stakeholders. Field studies were conducted with workers with multiple farm partners, assessing the HEAT intervention and work, environmental, and housing conditions. Our research recorded workers' heat exposure, tasks, signs of heat illness symptoms and biometrics. Also studied in real-life conditions is the possible association between heat strain during the workday and hot housing conditions.

Findings to Date

- Results from a pre/post knowledge assessment of 83 workers showed that our HEAT training:
  - Improved knowledge scores 4x more than those without the HEAT training.
  - Improved most in the areas of risk factors and treatments.
- Our physiological measures for heat strain (heart rate and core body temperature) showed greater heat strain with high effort and lower heat strain with older age.
- Results from participants self-reporting heat illness symptoms found associations with higher heat exposure, 10+ years agricultural work, not being an H-2A guest worker, and walking > 3 min to get to the toilet at work.
- We found variation in farmworker housing ambient conditions and reduced sleep duration in barrack-type housing.

Accomplishments

- In 2022 we refined heat exposure assessment protocols and collected data on heat exposure in different crops and shade conditions.
- The heat team has responded to community and stakeholder's requests for heat awareness information. Over 600 professionals trained in 6 courses (some in conjunction with AgriSafe, AIHA, NWCOSH, Harry Bridges Center).
- Produced a new radio program with Radio KDNA in Spanish on Heat and Smoke Symptoms with Dr. June Spector as the guest speaker.
- Integrated the HEAT into 4 Washington state grower information systems: AWNFarm WSU AgWeatherNet (8,850 farmers) and Harvust (6,342 farmers).
- Developed Heat-Related Illness eLearning course in conjunction with University of Washington Continuing Education Program.
- Since 2021, launched the Be Heat Smart campaign in collaboration with the WA State Department of Labor and Industries, building on our ongoing campaigns and national partners. In 2021, across all platforms, the campaign resulted in 31,118 impressions and 973 engagements.

Resources

Heat Illness Prevention, https://deohs.washington.edu/pnash/heat_illness

Heat Illness Toolkit, https://deohs.washington.edu/pnash/heat-toolkit

Heat-Related Illness Prevention PNASH Online On-Demand Courses, https://deohs.washington.edu/pnash/online-learning

“I believe this project will contribute to a reduction in adverse health effects of heat in workers, and that a healthy workforce is critical for sustaining productivity in the agricultural industry"

- Heat Project Advisor

View Burden Statement

PHS Inclusion Enrollment Report

This report format should NOT be used for collecting data from study participants.

OMB Number: 0925-0001
Expiration Date: 3/31/2020

***Study Title (must be unique):** Spector - A Multi-level Approach to Heat Related Illness Prevention in Agricultural Workers

* Delayed Onset Study? ☐ Yes ☒ No

If study is not delayed onset, the following selections are required:

Enrollment Type ☐ Planned ☒ Cumulative (Actual)

Using an Existing Dataset or Resource ☐ Yes ☒ No

Enrollment Location ☒ Domestic ☐ Foreign

Clinical Trial ☐ Yes ☒ No **NIH-Defined Phase III Clinical Trial** ☐ Yes ☒ No

Comments: UW IRB #238

Racial Categories	Ethnic Categories									
	Not Hispanic or Latino			Hispanic or Latino			Unknown/Not Reported Ethnicity			Total
	Female	Male	Unknown/ Not Reported	Female	Male	Unknown/ Not Reported	Female	Male	Unknown/ Not Reported	
American Indian/ Alaska Native	0	0	0	0	0	0	0	0	0	0
Asian	0	0	0	0	0	0	0	0	0	0
Native Hawaiian or Other Pacific Islander	0	0	0	0	0	0	0	0	0	0
Black or African American	0	0	0	0	0	0	0	0	0	0
White	0	2	0	5	2	0	0	0	0	9
More than One Race	0	0	0	0	1	0	0	0	0	1
Unknown or Not Reported	0	0	0	31	81	0	0	0	0	112
Total	0	2	0	36	84	0	0	0	0	122

Report 1 of 1

< Previous Report **Delete Report** **Next Report >**

To ensure proper performance, please save frequently.

A. COVER PAGE

Project Title: Yost – Injury and Illness Prevention for the Pacific NW Dairy Industry	
Grant Number: 5U54OH007544	**Project/Grant Period**: 09/30/2016 – 09/29/2022
Reporting Period: 09/30/2016 – 09/29/2022	**Date Submitted**: 12/28/2022
Program Director/ Principal Investigator Michael Yost, PhD, MPH Phone number: 206 685-7243 Email: airion@u.washington.edu	**Administrative Official Information** CAROL RHODES University of Washington Office of Sponsored Programs 4333 Brooklyn Ave NE SEATTLE, WA 98105 Phone number: 206-543-4043 Email: osp@uw.edu
Change of Contact PD/PI: NA	
Human Subjects: UW IRB #241, 11/1/2021 – 10/31/2022	**Vertebrate Animals:** No
hESC: No	**Inventions/Patents:** No

B. ACCOMPLISHMENTS

B.1. What are the major goals of the project?

Injury and Illness Prevention in the Pacific Northwest for the Dairy Industry
AIM 1 Identify common tasks and circumstances associated with acute injury risk in Washington Dairies
AIM 2 Survey current safety training and animal handling practices in Washington Dairies
AIM 3 Establish an EWG comprised of manager and workers involved in day-to-day activities on the dairy
AIM 4 Implement and evaluated selected training interventions with study population
AIM 5 Develop methodology for and conduct a dairy injury surveillance program
AIM 6 Translate results in a Best Practice Guide for minimizing injury in Washington Dairies

B.2. What did you accomplish under these goals?

AIM 1 Identify common tasks and circumstances associated with acute injury risk in Washington Dairies
We seek to reduce serious dairy worker injuries by tracking injuries and developing train-the-trainer programs and workplace practices that address high-risk work. Washington claims data shows that dairy workers in the state have a higher than average rate of injury than other industries. Dairy specific risks include animal assaults, slips and falls on wet surfaces and chronic injuries from repetitive stress.

Through data requests to the Washington State Department of Labor and Industries Safety and Health, we obtained a 6-year history of injuries classified according to SOC2K classification of industry18 and a separate 8-year de-identified case level dataset of dairy claims that included all reported injuries within industries classified as dairy farms (NAICS code 112120) as well as workers classified as dairy farm workers (WA Risk Class 7301). All data provided had personal identifiers removed prior to access by our research team. The 2006–2014-year history of injuries based on industry classification consists of year-by-year injury rates for industries classified as dairy farms.14 There were a total of 3,688 claims for compensable and non-compensable injuries reported to WA State Labor and Industries between 2009-2017. Since 2012, reported injury claims have increased by 23% [17-25%] based on a Local Polynomial Regression Fitting (LOESS) trend with the top three sources of injury during 2009-2017, where cattle (3.81 claims/100 FTE) represented 34% of all dairy worker claims. Bodily motion or position of injured or ill worker (0.86 claims/100 FTE), and floors, walkways, ground surfaces (0.77 claims/100 FTE) were the second and third most common sources of injury. The injury types reported as a result of interactions with cattle, highlighted the frequency of injuries to the hands, chest and knees, with lumbar, head and neck injuries driving the cost of these animal related injuries. The injury data collected as part of this project were shared with dairy stakeholder partners including the WA State Dairy Federation. Data were shared through a presentation at the annual dairy meeting in 20185, a dairy safety workshop presented as part of the 2020 WA Agriculture Safety Day Conference, as well as through a presentation at the 2019 Western Agriculture Safety and Health4 Conference. The data were also used to develop materials for an animal handling training focused on frequently reported injury types (described below) as well as a train-the-trainer program designed to enhance leadership and animal handling training on dairies.

AIM 2 Survey current safety training and animal handling practices in Washington Dairies
The original aim for this was completed in Year 3 with a Dairy Practice Survey of 34 dairies. A questionnaire was distributed to Washington and Oregon dairy producers at the 2018 Washington State Dairy Conference and the 2019 Oregon Dairy Farmers Association Annual Meeting. The needs assessment included questions related to farm demographics, current safety training resources and the effectiveness of these resources. We also included questions intended to help us identify training program characteristics that dairy owners expected from the development of future training programs. Fifty-five dairy producers completed the questionnaire. An analysis of the responses showed that Herd size ($P = 0.01$) and the number of nonfamily employees on a dairy ($P = 0.01$) was correlated with the amount of time per month Northwest dairy producers were willing to devote to health and safety training programs, in which producers with larger herds and more nonfamily employees were willing to devote more time. Most respondents (71%) believed that at least half their staff would benefit from Spanish training materials. Training sessions ranging from 30 minutes to one hour were favored by 82% of respondents. We heeded the information from this assessment when we designed subsequent dairy safety training resources. The data from this study is currently being prepared for a manuscript. Our findings supported the feasibility of a train-the-trainer model to improve safety on dairy farms and led to the LEADs training project under Dr. Progar Adams.

Additionally, from 2019-2020, the PNASH center worked with the Idaho Dairymen's Association to evaluate the impact of their on-farm iPad based training program by examining changes in pre-and-post test scores within 1,338 dairy workers undergoing on-farm training. Trade associations and industry groups such as the Idaho Dairymen's

Association (IDA) have worked to provide safety training solutions for workers within their state's dairy industry. In July 2017, the IDA created the Worker and Safety Training Program, in partnership with the High Plains Center for Agricultural Safety and Health (HICAHS) headquartered at Colorado State University, and the Southwest Center for Agricultural Health, Injury Prevention, and Education headquartered at the University of Texas Health Science Center at Tyler, Texas (SWCOEH). This training course has provided on-farm occupational safety training modules for thousands of Idahoan dairy workers. Additionally, the IDA has recognized the importance of providing safety training by "delivering authentic, on-farm training modules in native languages", with the intention of the course being to "promote worker safety, increase safety awareness, and reduce risk of injury and/or fatalities". To date, there have been few rigorous efficacy-based analyses of training programs with robust sample sizes within the dairy industry. Therefore, there is a need to analyze training record datasets such as the IDA's to assess the impact of demographic factors and assess changes in safety knowledge. Results from this analysis suggested important improvement in knowledge-based test scores for each language group when comparing between pre- and post-test scores. After stratifying by language, education was the most predictive variable of higher baseline scores and change in test scores amongst dairy safety course participants; English speakers had higher baseline scores than Spanish speakers. There was no significant evidence that either reading ease score or readability of individual questions, as assessed by a native Spanish speaker panel, were related to performance. The results show that dairy safety worker training results improved safety knowledge test scores. Education level appears to be a key determinant of increase in safety knowledge, and therefore, safety training programs need to address the learning needs of less educated workers. Further work is necessary to define optimal readability and applicability of written test questions as an assessment for Spanish language workers with little or no formal education. This effort both increased the collaboration between the PNASH center researchers, and the IDA as well as highlight the benefits of structured educational interventions on-farm.

AIM 3 Establish an EWG comprised of manager and workers involved in day-to-day activities on the dairy
Engagement with our EWG took place in-person initially and then was redirected to an online format. We developed a number of methods to elicit feedback on materials and approaches used to develop research questions and disseminate information throughout this project. The first was to present dairy focused sessions at the WA State Agricultural Safety Day events in 2019 and 2020. In these in-person events we invited participants to share top safety challenges, provide feedback on existing training materials and indicate preferred training modes. We had 20 participants in 2019 and 30 in 2020. We also conducted semi-structured interviews with managers and dairy safety representatives to identify needs and improvements in materials to be disseminated to the dairy industry. Feedback from these interviews included improved Spanish language access and reducing the amount of text in training materials. Lastly, we developed a continuing education module on accident prevention on dairies that we presented to participants live and made available asynchronously. The evaluations of this educational program were positive and indicated the need for further training materials, which we responded to through aims 6.

AIM 4 Implement and evaluated selected training interventions with study population
We recruited workers at three WA dairies to participate in either a PNASH designed interactive dairy training or a previously designed video-based training. Both trainings were offered in Spanish and in-person.
The interactive training included activities that allowed workers to discuss potential safety risks on their dairies. We assessed improvement in worker knowledge through changes in pre-post test scores among our participants. There were a total of 38 participants who received the video based training and 124 participants who received the interactive training. Overall, we saw significant improvement in the pre- and post- intervention scores for both groups. We observed significantly more improvement in the video training group as compared to the interactive group; however, after controlling for baseline pre-training score this was no longer significant. These data are currently being prepared for a manuscript. Participant retention in the follow-up survey was always challenging, and our text-message follow-up has proven highly successful. On-farm training was planned to continue in spring and summer 2020 but was halted due to COVID-19 restrictions.

Over the course of Fall 2020, project materials were converted to online offerings including the train-the-trainer program, an online toolkit to common dairy safety topics and tasks. Evaluation tools including online questionnaires and discussion boards were implemented. Key informant interviews were conducted with 4 industry representatives to determine the usability, value and improvements required to the toolkit.

AIM 5 Develop methodology for and conduct a dairy injury surveillance program
In Year 3, we completed this aim. We now have established a data-sharing agreement with WA LNI allowing for access to case level de-identified injury data from the dairy industry. This data has been redesigned into an interactive, online dashboard that we share annually with our dairy stakeholders and partners and updated with the most current data available.

AIM 6 Translate results in a Best Practice Guide for minimizing injury in Washington Dairies

Dairy Safety Toolkit (DSK)
The previously developed in-person train-the-trainer program was adapted for online format, as our team transitioned many research goals to online only format. The online format was co-developed by the UW PNASH Center, WSU Dairy Extension and the Washington State Dairy Federation, have created a safety curriculum for the dairy industry (English and Spanish tools). The DSK modules provide a complete overview of specific health and safety needs for the dairy industry. The platform includes resources such as PowerPoint training materials, factsheets, and applicable regulations. There are two versions users can choose from: 1) open website, or 2) an interactive online community for dairy operators. See https://deohs.washington.edu/pnash/dairysafetytoolkit.

The Dairy Safety Toolkit sub-project began in February 2019 with the aim of bringing bilingual and bicultural safety materials and training opportunities to dairy owners and managers. Through the Network, the online Dairy Safety Toolkit (DSK) provides curated training materials and tools to be used for on-site training of dairy workers. This portal also provides moderated discussion forums where users can share success stories and have questions answered by moderators. The online portal is also used to quickly disseminate emerging issues and changes in regulations. The dairy safety tool kit uses the Thinkific platform to provide educational materials and tools aimed at WA State dairy owners and managers. The development of the DSK was a joint effort of the PNASH Center, WA State University Animal Sciences, and the Washington State Dairy Federation (WSDF). Participation of the WSDF was directly funded through a Safety & Health Investment Projects (SHIP) Grant from the Washington State Department of Labor and Industries. The primary topic areas presented in the DSK were chosen to reflect the needs demonstrated by the LNI data claims (See Aim 1). We identified the most frequent types of injuries, injury sources, and injury types that had an increasing trend and developed or identified exiting materials addressing these hazards. Content was reviewed by LNI trainers for accuracy and relevance. This toolkit now includes 12 completed modules, in English and Spanish. There are currently 43 active users, most representing dairy owners and managers in WA State. In the platform, moderators, recruited by the Washington State Dairy Federation, interact with e-learners, answer subject-specific questions, and provide guidance on implementing on-farm training using module materials. Registered e-learners can self-guide their way through the DSK content, access and download materials, ask questions, and provide feedback on material effectiveness and ease of use. This is a flexible and bilingual platform that also allows for dissemination of emerging issues, changes in regulations, and other critical information. The current DSK was evaluated through semi-structured interviews with three stakeholders, including a representative of a major NW dairy co-op with the responsibility of managing worker safety, a large dairy producer and an industry group representative. The goal of the interview was to receive feedback on the quality of the content, the module's success in increasing safety on the farm, and the accessibility of the tool kit. The three stakeholders expressed strong interest in the DSK and they provided important feedback including reducing the density of material and developing Spanish
language translations for the entire content, which was completed in 2021.

B.3. Competitive Revisions/Administrative Supplements

The Year 6 extension, 2021-2022, was supported through an administrative supplement to PNASH.

B.4. What opportunities for training and professional development did the project provide?

WA Based Train-the-Trainer Dairy Leadership Certificate
The Pacific Northwest Agricultural Safety and Health Center has partnered with WSU Department of Animal Sciences to develop a unique train-the-trainer program Leaders Enabling Advanced Dairy Safety (LEADS), which certifies managers and owners to offer on-farm animal handling training specifically designed to promote worker and animal safety.3 More specifically, this training program was created from the injury claims data we discussed above. The training was designed to increase awareness of the four most common cattle-related injuries on dairies and offer recommendations on how dairy managers and owners can minimize the risk of these injuries. It also includes communication and leadership training components. The data-based nature of this program, coupled with its focus on injury prevention, makes the LEADS training program unique. This program has successfully trained 47 WA participants, from 16 different WA State dairies, since 2019 and plans to continue offering in-person sessions through the support of the Pacific Northwest Agricultural Safety and Health Center. Upon completion of the LEADS training, each participant received copies of all the training materials to take back to their respective farms and share with their co-workers. Based on program assessments, 100% of LEADS participants learned something new and 86% of participants planned to use the LEADS training materials on their farms. On average, LEADS participants increased their knowledge about dairy cattle handling safety by 20%. Outreach to program graduates indicated the need for more support in offering on-farm training for participants. In order to respond to this need the WA State Dairy Federation,

WSU and UW, have collaborated to develop the e-learning Dairy Safety Kit (DSK) platform which provides curated content and an interactive learning experience tailored to WA dairy workers.

Other
In collaboration with our partners at WSU and the WA Dairy Federation, we organized a one hour interactive workshop for owners, managers and herdsman to discuss and share perspectives on tools related to safety meetings, animal handling and accident prevention plans. Twenty owners, managers, and herdsmen participated in this online workshop called 'Think Safety, It Won't Hurt.'

The Washington Dairy Federation has now partnered with the Washington Governor's Safety Conference focused on agriculture, Ag Safety Day. This event is the first of its kind for our state, offering safety training for the state's hired dairy workforce (English and Spanish sessions). They plan to continue the safety training event annually.

B.5. How did you disseminate the results to communities of interest?

The Dairy Safety Toolkit online portal is used to quickly disseminate project reslts, emerging issues and changes in regulations. In addition, an in-person train-the-trainer animal handling program, LEADS, developed by Amber Adams-Progar at Washington State University is now a regular program that provides dairy operators in Idaho and Oregon with preventive strategies that target commonly reported animal-related injuries. For Idaho, we work with our Idaho Dairyman Association partners to share results.

B.6 - What do you plan to do during the next reporting period to accomplish the goals?

This is the final year of this project, yet PNASH Dairy industry engagement and training continues into our awarded 2022-2027 cycle. Current activities are supported by the PNASH Outreach Core and Evaluation and Planning Core to continue to join our partners in training and education, and to engage industry in assessing needs and addressing these through new prevention and research projects. Dr. Elena Austin has submitted a research proposal to NIOSH in Fall 2020 with a technology solution for addressing animal handling injuries.

C. PRODUCTS

C.1. Publications, conference papers, and presentations

Austin E, Adams-Progar A, Cruz I, Palmandez P, Dilley S, Yost M. Dairy Safety Kit: An Innovative Online Based Training and Outreach Solution. Journal of Agromedicine. 2021-2, 25(3):232. **PMCID pending.**

Benoit M. Efficacy in Occupational Safety and Health Training of Dairy Workers: Predictors of Test Performance on a Dairy Safety Knowledge Test from a Demographic Cohort. 2021 Master's of Public Health Thesis. Department of Environmental and Occupational Health Sciences, University of Washington, Seattle, Washington. ResearchWorks.

Adams-Progar A, Kristula M, Hain MV. Dairy Cattle Handling Extension Programs: Training Workers and Cattle. The Journal of Extension. 2019, 57(4):7. **PMCID pending.**

C.2. Website(s) or other Internet site(s) – include URL(s)
https://deohs.washington.edu/pnash/dairysafetytoolkit
https://deohs.washington.edu/pnash/partnership-dairy-safety-and-health
Educational aids or curricula Online dairy safety courses: https://dairy-safety.thinkific.com/manage/courses/

C.3. Technologies or techniques

NA

C.4. Inventions, patent applications, and/or licenses

NA

C.5. Other products and resource sharing

Protocol: Dairy Safety Project Data Management and Access Plan

Online learning: Dairy Safety Toolkit
https://deohs.washington.edu/pnash/dairysafetytoolkit

Fact Sheets:
Mapping Activity: Identifying Hazards
https://deohs.washington.edu/pnash/sites/deohs.washington.edu.pnash/files/2020-06/MappingActivity-SPNandENGMaps2June2020.pdf

Conducting a Safety Meeting
https://deohs.washington.edu/pnash/sites/deohs.washington.edu.pnash/files/2020-06/ConductingASafetyMeeting2June2020.pdf

D. PARTICIPANTS

D.1. What individuals have worked on the project? Please include calendar, academic, and summer months.

Commons ID	S/K	Name	Degrees(s)	Role	Cal	Aca	Sum	Foreign	Country	SS
airion	x	Michael Yost	BA,MS,PHD	Project PI	1.2					
ELENAAUSTIN	x	Elena Austin	MS,DSC	Co-Investigator	3.6					
KITGALVIN	x	Kit Galvin	BA, MS, CIH	Research Scientist	.6					
		Pablo Palmandez	MS	Research Coordinator	2.4					
		Sarah Fish		Media Specialist	1.56					
		Ilsa Olsen		Program Coordinator	1.2					
		Idanis Cruz		Research Coordinator	1.2					

D.2 Personnel updates

a. Level of Effort: NA

b. New Senior/Key Personnel: NA

c. Changes in Other Support: No changes for this period.

d. New Other Significant Contributors: NA

E. IMPACT

E.1 - What is the impact on the development of human resources, if applicable?

Washington State claims data indicates that diary workers in the state have a higher than average rate of injury than the overall worker population. Industry specific risks include acute injuries from animal assaults, slips and falls on wet surfaces and chronic injuries from repetitive stress. Targeting worker training, supervisor training, and their physical environment will result in workers adopting safer and more efficient working practices.

E.2 - What is the impact the Public Health Relevance and Impact? The investigator should address how the findings of the project relate beyond the immediate study to improved practices, prevention or intervention techniques, legislation, policy, or use of technology in public health.

Using an interactive platform such as the Dairy Safety Toolkit provides a safe learning and sharing environment for dairy producers, workers, and supervisors. The platform includes resources such as training, factsheets, and links to reliable websites. There has been tremendous interest in this product as well as the WSU LEADS and National FARM Program, and we anticipate it will change the way safety information can be communicated to dairy workers in our region.

F. CHANGES

F.1 - Changes in approach and reasons for change, including changes that have a significant impact on expenditures

No changes

F.2 - Actual or anticipated challenges or delays and actions or plans to resolve them

NA

F.3 - Significant changes to human subjects, vertebrate animals, biohazards, and/or select agents

No significant changes.

G. Special Reporting Requirements

G.1 Special Notice of Award Terms and Funding Opportunities Announcement Reporting Requirements
NA

G.2 Responsible Conduct of Research
NA

G.3 Mentor's Research Report or Sponsor Comments
NA

G.4 Human Subjects

G.4.a Does the project involve human subjects?
Yes

G.4.b Inclusion Enrollment Data
See table following this project report.

G.4.c ClinicalTrials.gov
Does this project include one or more applicable clinical trials that must be registered in ClinicalTrials.gov under FDAAA?
No

G.5 Human Subject Education Requirement

Are there personnel on this project who are newly involved in the design or conduct of human subject's research?
No

G.6 Human Embryonic Stem Cells (HESCS)

Does this project involve human embryonic stem cells (only hESC lines listed as approved in the NIH Registry may be used in NIH funded research)?
No

G.7 Vertebrate Animals

Does this project involve vertebrate animals?
No

G.8 Project/Performance Sites
University of Washington, Seattle, WA
Washington State University, Pullman, WA

G.9 Foreign Component

NA

G.10 Estimated Unobligated Balance
G.10.a Is it anticipated that an estimated unobligated balance (including prior year carryover) will be greater than 25% of the current year's total approved budget?

No

G.11 Program Income

Is program income anticipated during the next budget period?

Yes

G.12 F&A Costs

Is there a change in performance sites that will affect F&A costs?
No

I. OUTCOMES

I. Provide a concise summary of the outcomes or findings of the award, written for the general public in clear and comprehensible language, without including any proprietary, confidential information or trade secrets

Note: project outcome information will be made public in NIH RePORTER

INJURY AND ILLNESS PREVENTION FOR THE PACIFIC NW DAIRY INDUSTRY
https://deohs.washington.edu/pnash/injury-and-illness-prevention-pacific-northwest-dairy-industry

Challenge

Worker's compensation claims data show dairy workers have a higher injury rate than workers in other industries. Industry specific risks include acute injuries from animal assaults, slips and falls on wet surfaces, and chronic injuries from repetitive stress. For many hired diary workers, Spanish is their primary language.

Project Overview

We seek to reduce serious dairy worker injuries by tracking injuries, examining high risk work tasks with farmers and workers, and developing train-the-trainer programs and a best practices guide. The Dairy Safety Kit (DSK) was developed based on training needs identified in a survey of PNW dairy producers. Different safety formats and training approaches are being piloted to determine which have the greatest impact on dairy employee learning and safety. We also worked to establish a system to track dairy worker injuries. An online interactive dashboard was developed to share data visually with dairy stakeholders and partners. We combine expertise from Washington State University (WSU)'s Department of Animal Sciences, Washington State Department of Labor and Injuries (LNI) Safety and Health Assessment and Research for Prevention (SHARP) Program, and the Washington State Dairy Federation.

Findings to Date

- Review of Dairy industry workers compensation claims **showed animal handling** and **slips of floors and walkways** as the key injury prevention need and training priority. The Dairy Safety Kit training prioritizes these topics.
- In Washington, we assessed PNASH's interactive in-person training in Spanish (124 participants) compared to our training video (38 participants). Overall, we saw significant improvement in the pre- and post- knowledge scores for both groups with no significant difference between the two formats.
- With the Idaho Dairymen's Association, evaluated their training with 1,338 dairy workers. Results showed improved safety knowledge test scores. Education level was a key determinant of increase in safety knowledge, and therefore, safety training programs and their test questions need to address the needs of Spanish language workers with little or no formal education.
- Findings from our Dairy Practice Survey support the feasibility of a train-the-trainer model to improve safety on dairy farms.

Other Accomplishments

We have expanded our partnerships to Idaho and Oregon states, working with partners to improve their safety training.

- Published The Dairy Safety Kit has been adopted by the Dairy Safety Network and the WA Leaders Enabling Advanced Dairy Safety (LEADS) Train-the-Trainer Program. Participants are manager level and owners of WA

state dairies. We currently have 35 enrolled participants representing dairies ranging from one employee to 150 employees.
- This project and partnership served as the foundation for the new WSU-hosted train-the-trainer program, Leaders Enabling Advanced Dairy Safety (LEADS). Last year LEADS workshop trainings took place in Washington and Oregon, with 62 dairy safety leaders completing the course.
- Hosted workshop, using scenario-based training, in partnership with Dr. Progar and the Washington State Dairy Federation.

Next Steps

Currently manuscripts are being prepared for publication on evaluation of our trainings in Washington state. We will continue to work with our partners to develop a sustainable regional training solution for dairy workers, including Spanish language.

Resources

Partnership for Dairy Safety and Health, https://deohs.washington.edu/pnash/partnership-dairy-safety-and-health

Dairy Safety Toolkit, https://deohs.washington.edu/pnash/dairysafetytoolkit

"I spent hours researching relevant safety materials to use for training my workers. I wish there was one place I could go to have access to everything I need."
- Dairy Farm Owner

View Burden Statement

PHS Inclusion Enrollment Report

This report format should NOT be used for collecting data from study participants.

OMB Number: 0925-0001
Expiration Date: 3/31/2020

***Study Title (must be unique):** Yost - Injury and Illness Prevention in the Pacific Northwest for the Dairy Industry

* Delayed Onset Study? ☐ Yes ☒ No

If study is not delayed onset, the following selections are required:

Enrollment Type ☐ Planned ☒ Cumulative (Actual)

Using an Existing Dataset or Resource ☐ Yes ☒ No

Enrollment Location ☒ Domestic ☐ Foreign

Clinical Trial ☐ Yes ☒ No **NIH-Defined Phase III Clinical Trial** ☐ Yes ☒ No

Comments: UW IRB #241

Racial Categories	Ethnic Categories									
	Not Hispanic or Latino			Hispanic or Latino			Unknown/Not Reported Ethnicity			Total
	Female	Male	Unknown/ Not Reported	Female	Male	Unknown/ Not Reported	Female	Male	Unknown/ Not Reported	
American Indian/ Alaska Native	0	0	0	0	0	0	0	0	0	0
Asian	0	0	0	0	0	0	0	0	0	0
Native Hawaiian or Other Pacific Islander	0	0	0	0	0	0	0	0	0	0
Black or African American	0	0	0	0	0	0	0	0	0	0
White	0	0	0	0	0	153	0	0	0	153
More than One Race	0	0	0	0	0	0	0	0	0	0
Unknown or Not Reported	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	153	0	0	0	153

Report 1 of 1

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A. COVER PAGE

Project Title: Kincl - Safety Surveillance for Pacific Northwest Fisheries	
Grant Number: 5U54OH007544	**Project/Grant Period**: 09/30/2016 – 09/29/2022
Reporting Period: 09/30/2016 – 09/29/2022	**Date Submitted**: 12/28/2022
Program Director/ Principal Investigator LAUREL KINCL , PHD, MPH Phone number: 206 685-7243 Email: Laurel.Kincl@oregonstate.edu	**Administrative Official Information** Tuba Ozkan-Haller Sponsored Research and Award Development Oregon State University Corvallis, OR 97331-2140 Phone number: 541 737-4933 Email: sponsored.programs@oregonstate.edu
Change of Contact PD/PI: NA	
Human Subjects: OSU IRB #7633 10/19/21-10/18/22	**Vertebrate Animals:** No
hESC: No	**Inventions/Patents:** No

B. ACCOMPLISHMENTS

B.1. What are the major goals of the project?

Safety Surveillance for Pacific Northwest Fisheries
AIM 1 Create a practical, scalable commercial fishery surveillance system for the Pacific Northwest
AIM 2 Assess the utility and accuracy of commercial fishing surveillance data
AIM 3 Develop evidence-based hazard assessments with commercial fishery stakeholders

B.2. What did you accomplish under these goals?

AIM 1 Create a practical, scalable commercial fishery surveillance system for the Pacific Northwest

This comprehensive data project, RISC Fishing, used multiple datasets to estimate injury risk and risk factors for Pacific Northwest commercial fishing. Our goal was to work in partnership with fisheries to pinpoint and address hazards. RISC Fishing developed a new Commercial Fishing Incident Database (CFID) to provide routine, accurate, and automated data linkage. The CFID 2.0 is managed by the NIOSH Western States Division. A version of the RISC Fishing (Risk Information System for Commercial Fishing) database is retained locally at Oregon State University.

All objectives above related to the CFID 2.0 (at NOISH WSD) and the RISC System (at OSU) have been met. CFID 2.0 continues to be managed by the NIOSH Western States Division.

AIM 2 Assess the utility and accuracy of commercial fishing surveillance data

We identified true matches and discrepancies between de-identified data sets using the Python Record Linkage Toolkit. Four commercial fishing data sets from Oregon and Washington were linked: the Commercial Fishing Incident Database, the Vessel Casualty Database, the Nonfatal Injuries Database, and the Oregon Trauma Registry. The data sets each covered different date ranges within 2000-2017, containing 458, 524, 184, and 11 cases respectively. Several data linkage classifiers were evaluated. The Naïve-Bayes classifier returned the highest number of true matches between these small data sets. A total of 41 true matches and 8 close matches were identified, of which 29 were determined to be duplicates. In addition, linkage highlighted 4 records that were not commercial fishing cases from Oregon and Washington. The optimum match parameters were the date, state, vessel official number, and number of people on board.

Overall, statistical data linkage enables accurate, routine matching for small de-identified injury and fatality data sets such as those in commercial fishing. It provides information needed to improve the accuracy of existing data records. It also enables expanding and sharpening details of individual incidents in support of occupational safety research.

The evaluation of state trauma registry data showed that state trauma system data may be of limited utility in identifying commercial fishing injury incidents, but may be more useful in identifying farming or logging incidents.

Public use files (i.e. de-identified) from population-based surveillance systems provide commercial fishermen health and safety information but *cannot be reliably linked* to provide accurate and comprehensive surveillance. Utilizing the National Institute for Occupational Safety and Health–Worker Health Charts, we estimated prevalence of general exposures, psychosocial exposures, health behaviors, and health conditions from the national surveys National Health Interview Survey - Occupational Health Supplement (NHIS-OHS, 2015) and Behavioral Risk Factor Surveillance System (BRFSS) (2013-2015).

The Haddon matrix analyses used were constructive to identify potential nonfatal injury-associated factors. We assessed injury events from 245 nonfatal commercial fishing injuries in the Pacific Northwest (2000-2018),

Findings from our analyses using CFID 2.0 to-date:

- Analysis of 245 nonfatal commercial fishing injuries in the Pacific Northwest (2000-2018), identified the top three injury events:

- **Contact with objects** (108 events). Fishing gear (40%) was the dominant injury source, most often due to hauling the fishing gear (22%). Handling heavy loads (32%) and contact with unsecured objects (27%) often resulted in injuries.
- **Transportation (**58 events). Most often occurred in the catcher-vessels (93%) and smaller vessels (< 5 crew) (74%). Vessel casualties (91%) were common and often due to striking rocks/bottom (29%) or fire and explosion (19%). Crew abandoned to water (38%) due to no life raft or raft malfunctions.
  Slip, trip, and fall injuries (43 events) typically happened with onboard traffic (49%). Such events were largely experienced by the catcher-processors (44%) including large vessels with >100 crew (28%).
- Analysis of 93 commercial fishing fatalities found that vessel casualties were the most common incident (67%). Falls overboard (20%) most commonly occurred with deckhands (71%) and in the Dungeness crab fishery (41%). The two main causes were slips and trips (35%) and being knocked by gear or gear entanglements (29%). None of the fall-overboard victims were wearing PFDs.

AIM 3 Develop evidence-based hazard assessments with commercial fishery stakeholders

RISC Fishing partners with the CDC/NIOSH Commercial Fishing Safety Program and was guided by a Technical Advisory Board (TAB), including the United States Coast Guard, Washington and Oregon fisheries management professionals, the Oregon Health Authority, the National Oceanic and Atmospheric Association, the Alaska Marine Safety Education Association (AMSEA), health and safety professionals, and Sea Grant commercial fishing extension agents.

The RISC TAB was established in 2017 and met twice every year through the project period. The purpose of the TAB was to identify relevant commercial fishing industry issues and priorities and to help translate surveillance findings into tailored responses for the industry's hazard assessment needs. TAB members were recruited based on their ability to represent key stakeholders and willingness to engage in board meetings. An evaluation of the TAB was recently undertaken by reviewing the membership/retention, reviewing meeting notes and correspondences, and surveying the members. The internal review shows that the TAB members are an invaluable resource and have greatly contributed to the direction of the project as well as provided insight into their fields and how the RISC Fishing system could be useful to a variety of stakeholders. The survey of TAB members indicated that they felt that their participation was useful and valuable in forming connections with other stakeholders and learning about what is happening in terms of commercial fishing safety within the project and with other TAB members. In the proposed expansion of RISC, we will use this successful experience to engage with project-specific advisories, and engage our own technical advisers around data sources (e.g. trauma registries, workers' compensation) or specific locations (i.e. states).

B.3. Competitive Revisions/Administrative Supplements

NA

B.4. What opportunities for training and professional development did the project provide?

We held three trainings held this past November 2020 to January 2021 in Oregon and Washington. We had 30 fishermen attend our First Aid and Safety Trainings and use the RISC project hazard sheet.

B.5. How did you disseminate the results to communities of interest?

Study results were published, integrated into our FLIPP training program with AMSEA and our NIOSH T03 project, "Building Capacity for Fishermen First Aid and Safety Training (FFAST)"

Through social media, in 2022 our 'Fishing Fridays' shared RISC findings and resources for mental health. In total 24 social media posts were developed reaching 814 people.

B.6 - What do you plan to do during the next reporting period to accomplish the goals?

This project is now closed, but will continue under PNASH through a new 5-year RISC project spanning the northwest and including farming, forestry and fishing sectors. We anticipate ample cases will be detected as we expand from Washington and Oregon to the entire four state region, and from fishing to farming, forestry, and fishing. Pilot data

suggest that the proposed data sources will readily identify agriculture and forestry cases. For instance, in our initial drawdown of Oregon Trauma Registry data, we identified only 9 commercial fishing injury incidents, but at least 151 farming and 298 forestry incidents over the same 7-year time period; many others will be identified through narrative review and machine learning approaches to case identification.

C. PRODUCTS

C.1. Publications, conference papers, and presentations

Doza S, Bovbjerg VE, Vaughan A, Nahorniak JS, Case S, Kincl LD. Health-Related Exposures and Conditions among US Fishermen. Journal of Agromedicine. 2022 Jul;27(3):284-291. doi: 10.1080/1059924X.2021.1944416. Epub 2021 Jul 6. PMID: 34228604; PMCID: PMC8969888.

Lincoln JM, Carruth A, Cherry D, Kincl L, Syron LN. Occupational Health Research in the Commercial Fishing Industry. Journal of Agromedicine. 2021 Jan;26(1):28-30. doi: 10.1080/1059924X.2021.1849494. Epub 2021 Jan 25. PMID: 33487133. **PMCID pending**

Nahorniak J, Bovbjerg V, Case S, Kincl L. Application of Data Linkage Techniques to Pacific Northwest Commercial Fishing Injury and Fatality Data. Injury Epidemiology. 2021 Jul 5;8(1):26. doi: 10.1186/s40621-021-00323-z. PMID: 34218819; PMCID: PMC8256577.

Vaughan A, Bovbjerg V, Doza S, Kincl L. Evaluation of a Technical Advisory Board for an Occupational Injury Surveillance Research Project: A Qualitative Study. Health Science Reports. 2022 Aug 8;5(5):e777. doi: 10.1002/hsr2.777. PMID: 35949683; PMCID: PMC9358660.

C.2. Website(s) or other Internet site(s) – include URL(s)

https://deohs.washington.edu/pnash/fishing-safety

https://health.oregonstate.edu/labs/osh/resources/flipp

C.3. Technologies or techniques

Version 2.0: Commercial Fishing Incident Database (CFID)

C.4. Inventions, patent applications, and/or licenses

NA

C.5. Other products and resource sharing

Protocol: RISC Fishing Data Management and Access Plan
Hazard Assessment Tool: Operator self-assessment sheet for use on vessels
Article: RISC Information for Commercial Fishing, https://deohs.washington.edu/pnash/blog/risc-information-commercial-fishing
Outreach Products: 16 outreach products and 3 trade articles. Products included Hazard Sheets, Placemats and RISC Fishing Findings were developed to promote injury prevention.
Data Dashboard: **RISC Commercial Fishing Injury Data Visualization.** Users can explore trends by state, injury event, source of injury, fishery and gear type. https://health.oregonstate.edu/labs/osh/resources/risc/data-visualizationOregon State University

Training: https://health.oregonstate.edu/labs/osh/resources/flipp

D. PARTICIPANTS

D.1. What individuals have worked on the project? Please include calendar, academic, and summer months.

Commons ID	S/K	Name	Degrees(s)	Role	Cal	Aca	Sum	Foreign	Country	SS
Linkcl06	x	Laurel Kincl	PhD, MPH	Project PI	4.5					NA
bovbjerg	x	Viktor Bovbjerg	PhD	Co- PI	4.5					NA
		Amelia Vaughn		Manager	12.0					NA
		Abeer Doza		Grad Assist	4.0					NA

D.2 Personnel updates

a. Level of Effort: NA

b. New Senior/Key Personnel: NA

c. Changes in Other Support: No changes for this period.

d. New Other Significant Contributors: NA

E. IMPACT

E.1 - What is the impact on the development of human resources, if applicable?

The RISC project contributes to the resource development to support industry and national surveillance efforts. In addition, this project integrates student projects, offering applied science experience, occupational health mentoring and financial support.

E.2 - What is the impact the Public Health Relevance and Impact? The investigator should address how the findings of the project relate beyond the immediate study to improved practices, prevention or intervention techniques, legislation, policy, or use of technology in public health.

Commercial fishing is a high-risk industry with high fatality and injury rates, and is an important regional industry in the Pacific Northwest. This project will provide a surveillance system to be used as a tool to track details of personal and vessel casualties and disasters, and to compile and develop hazard assessments to inform evidence-based intervention strategies. The RISC system in the Pacific Northwest can serve as a model for other regional or national efforts. The national Commercial Fishing Incident Database (CFID) was upgraded to CFID 2.0 and is now being used by CDC-NIOSH and the Us Coast Guard.

F. CHANGES

F.1 - Changes in approach and reasons for change, including changes that have a significant impact on expenditures

No significant changes.

F.2 - Actual or anticipated challenges or delays and actions or plans to resolve them

The COVID-19 pandemic has slowed our ability to obtain data in a timely manner. State employees with access to data have been pulled substantially or entirely into COVID-19 duties. Even staff at national data sources (e.g. National Trauma Data Bank) paused operations. The supplemental Year 6 enabled this project to complete aims as planned.

F.3 - Significant changes to human subjects, vertebrate animals, biohazards, and/or select agents

No significant changes.

G. Special Reporting Requirements

G.1 Special Notice of Award Terms and Funding Opportunities Announcement Reporting Requirements
NA

G.2 Responsible Conduct of Research
NA

G.3 Mentor's Research Report or Sponsor Comments
NA

G.4 Human Subjects

G.4.a Does the project involve human subjects?
Yes

G.4.b Inclusion Enrollment Data
See table following this project report.

G.4.c ClinicalTrials.gov
Does this project include one or more applicable clinical trials that must be registered in ClinicalTrials.gov under FDAAA?
No

G.5 Human Subject Education Requirement

Are there personnel on this project who are newly involved in the design or conduct of human subject's research?
No

G.6 Human Embryonic Stem Cells (HESCS)

Does this project involve human embryonic stem cells (only hESC lines listed as approved in the NIH Registry may be used in NIH funded research)?
No

G.7 Vertebrate Animals

Does this project involve vertebrate animals?
No

G.8 Project/Performance Sites
Oregon State University, Corvallis, Oregon

G.9 Foreign Component

NA

G.10 Estimated Unobligated Balance
G.10.a Is it anticipated that an estimated unobligated balance (including prior year carryover) will be greater than 25% of the current year's total approved budget?

No

G.11 Program Income

Is program income anticipated during the next budget period?
Yes

G.12 F&A Costs

Is there a change in performance sites that will affect F&A costs?
No

I. OUTCOMES

I. Provide a concise summary of the outcomes or findings of the award, written for the general public in clear and comprehensible language, without including any proprietary, confidential information or trade secrets

Note: project outcome information will be made public in NIH RePORTER

SAFETY SURVEILLANCE FOR PACIFIC NORTHWEST COMMERCIAL FISHING: Risk Information System for Commercial (RISC) Fishing
https://deohs.washington.edu/pnash/fishing-safety

Challenge
Commercial fishing is vital to Pacific Northwest economies and communities. Compared to other industries, it is one of the most hazardous due to higher rates of serious injuries and deaths. There is a need for risk information systems to identify the causal factors of these injuries to better inform and evaluate prevention solutions.

Project Overview

This comprehensive data project, RISC Fishing, used multiple datasets to estimate injury risk and risk factors for Pacific Northwest commercial fishing. Our goal was to work in partnership with fisheries to pinpoint and address hazards. RISC Fishing developed a new Commercial Fishing Incident Database (CFID) to provide routine, accurate, and automated data linkage that is currently in use by NIOSH and industry partners.

Findings to Date

Analysis of 245 nonfatal commercial fishing injuries in the Pacific Northwest (2000-2018), identified the top three injury events:

- **Contact with objects** (108 events). Fishing gear (40%) was the dominant injury source, most often due to hauling the fishing gear (22%). Handling heavy loads (32%) and contact with unsecured objects (27%) often resulted in injuries.
- **Transportation (**58 events). Most often occurred in the catcher-vessels (93%) and smaller vessels (< 5 crew) (74%). Vessel casualties (91%) were common and often due to striking rocks/bottom (29%) or fire and explosion (19%). Crew abandoned to water (38%) due to no life raft or raft malfunctions.
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- Analysis of 93 commercial fishing fatalities found that vessel casualties were the most common incident (67%). Falls overboard (20%) most commonly occurred with deckhands (71%) and in the Dungeness crab fishery (41%). The two main causes were slips and trips (35%) and being knocked by gear or gear entanglements (29%). None of the fall-overboard victims were wearing PFDs.

Other Accomplishments

- **Successful** completion of the CFID 2.0 and continues to be managed by the NIOSH Western States Division.
- 16 outreach products and 3 trade articles. Products included Hazard Sheets, Placemats and RISC Fishing Findings were developed to promote injury prevention.
- A publicly available interactive injury data visualization tool, **RISC Commercial Fishing Injury Data Visualization.** Users can explore trends by state, injury event, source of injury, fishery and gear type.
- In 2022 our 'Fishing Fridays' shared RISC findings and resources for mental health. In total 24 social media posts were developed reaching 814 people.
- The Haddon matrix analyses used were constructive to identify potential nonfatal injury-associated factors.
- An evaluation of state trauma registry data showed that state trauma system data may be of limited utility in identifying commercial fishing injury incidents, but may be more useful in identifying farming or logging incidents.
- RISC Fishing partners with the CDC/NIOSH Commercial Fishing Safety Program and was guided by a Technical Advisory Board (TAB), including the United States Coast Guard, Washington and Oregon fisheries management professionals, the Oregon Health Authority, the National Oceanic and Atmospheric Association, the Alaska Marine Safety Education Association (AMSEA), health and safety professionals, and Sea Grant commercial fishing extension agents. An evaluation of the TAB demonstrated the strength of their contributions toward the project and reciprocal benefits to their programs.

Resources

RISC – Risk Information System for Commercial Fishing, https://health.oregonstate.edu/labs/osh/resources/risc
Commercial Fishing Injury Data Visualization | RISC Fishing,
https://health.oregonstate.edu/labs/osh/resources/risc/data-visualization

Training

FLIPP Resources for Commercial Fishermen, https://health.oregonstate.edu/labs/osh/resources/risc/data-visualization
FFAST – Fishermen First Aid and Safety Training, https://health.oregonstate.edu/labs/osh/resources/ffast

"The redesigned CFID has been instrumental in our ability to be responsive to stakeholders. Since its rollout, we have fulfilled numerous data requests from fishery managers, the US Coast Guard, marine safety trainers, and journalists."

- Samantha Case, NIOSH Western States Division

View Burden Statement

PHS Inclusion Enrollment Report

This report format should NOT be used for collecting data from study participants.

OMB Number: 0925-0001
Expiration Date: 3/31/2020

***Study Title (must be unique):** Kincl - Safety Surveillance for Pacific Northwest Fisheries

* Delayed Onset Study? ☐ Yes ☒ No

If study is not delayed onset, the following selections are required:

Enrollment Type ☒ Planned ☐ Cumulative (Actual)

Using an Existing Dataset or Resource ☒ Yes ☐ No

Enrollment Location ☒ Domestic ☐ Foreign

Clinical Trial ☐ Yes ☒ No **NIH-Defined Phase III Clinical Trial** ☐ Yes ☒ No

Comments: OSU IRM #7633

Racial Categories	Ethnic Categories									
	Not Hispanic or Latino			Hispanic or Latino			Unknown/Not Reported Ethnicity			Total
	Female	Male	Unknown/ Not Reported	Female	Male	Unknown/ Not Reported	Female	Male	Unknown/ Not Reported	
American Indian/ Alaska Native	0	2	0	0	0	0	0	0	0	2
Asian	0	0	0	0	0	0	0	0	0	0
Native Hawaiian or Other Pacific Islander	0	0	0	0	0	0	0	0	0	0
Black or African American	0	2	0	0	0	0	0	0	0	2
White	0	257	0	0	0	0	0	0	0	257
More than One Race	0	0	0	0	0	0	0	0	0	0
Unknown or Not Reported	0	0	0	0	0	0	0	0	0	0
Total	0	261	0	0	0	0	0	0	0	261

Report 1 of 1

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A. COVER PAGE

Project Title: Galvin - Practical Solutions for Pesticide Safety	
Grant Number: 5U54OH007544	**Project/Grant Period**: 09/30/2016 – 09/29/2022
Reporting Period: 09/30/2016 – 09/29/2022	**Date Submitted**: 12/28/2022
Program Director/ Principal Investigator Kit Galvin, MS, CIH Phone number: 206 685-7243 Email: kgalvin@uw.edu	**Administrative Official Information** CAROL RHODES University of Washington Office of Sponsored Programs 4333 Brooklyn Ave NE SEATTLE, WA 98105 Phone number: 206-543-4043 Email: osp@uw.edu
Change of Contact PD/PI: NA	
Human Subjects: UW IRB #235, 2/25/2022 – 3/24/2023	**Vertebrate Animals:** No
hESC: No	**Inventions/Patents:** No

B. ACCOMPLISHMENTS

B.1. What are the major goals of the project?

Practical Solutions for Pesticide Safety
AIM 1 Establish advisory groups to inform the development and dissemination of new practical solutions for handheld pesticide application equipment
AIM 2 Develop practical solutions for pesticide safety for handheld application equipment
AIM 3 Disseminate Practical Solutions for Pesticide Safety

B.2. What did you accomplish under these goals?

This education project identifies, evaluates, and adapts pesticide safety solutions that Northwest farmers developed for themselves. These practical solutions are then shared back to the industry through an online platform. This project focuses on handheld application equipment and builds upon our previous Practical Solutions for Pesticide Safety guide for broadcast spraying. This project is useful to nurseries, greenhouses, grass seed production, and reforestation industries with solutions that 1) reduce exposure; 2) are practical, compatible, convenient, adaptable, safe, novel, and meet regulations; and 3) support the requirements and training needs of the revised US EPA Worker Protection Standard. Visit https://deohs.washington.edu/pnash/handheld-psps to view these solutions in English and Spanish.

AIM 1 Establish advisory groups to inform the development and dissemination of new practical solutions for handheld pesticide application equipment
This project engaged an Expert Working Group (EWG) to and then an Expert Review Group (ERG). Both engaged industry managers, supervisors, and pesticide handlers. Due to COVID-19 protections and resource demands on the essential agricultural industry, most activities were postponed. We subsequently developed COVID-19 precautions for safe remote work and we will be able to continue with our advisors.

AIM 2 Develop practical solutions for pesticide safety for handheld application equipment
PNASH works with farmers, educators, and researchers across the Northwest to test and develop solutions originally developed by growers and workers for themselves. We have expanded from our original airblast application systems, to now include handheld and greenhouse applications. Each solution is assessed for the goals:
1) reduce exposure,
2) are practical, compatible, and convenient,
3) support the requirements and training for state regulations
and the revised US EPA Worker Protection Standard.

Findings to Date
- 50% interviewees have story of adoption/use in field.
- Reviewers found the online solutions visually appealing and accurate and the curated solutions useful.

Accomplishments
- 21 new solutions have been published in English and Spanish on our webpage. Each solution describes how pesticide exposure is reduced and share practices to reduce the exposure including a supply list, tips, photos, setup and use instructions, and links for more WPS information and relevant regulations.
- Developed a new remote approach to engage partners by providing a custom tablet used to gather pictures and conduct live walk-throughs and interviews.
- Completed adoption scenarios. For example, a participant adopted the room access protocol solution, motivated by the use of less pesticide products because they would only need to treat one room instead of several rooms.
- Developed a new PNASH e-learning course, Pesticide Learning Solutions, to demonstrate how to read a pesticide label, discuss pesticide exposure pathways and how to reduce exposure, share best practices for pesticide application, and provide pesticide safety resources from PNASH and regional and national sources.

AIM 3 Disseminate Practical Solutions for Pesticide Safety

A new bilingual (Spanish and English) website platform integrates the finalized solutions. This platform and a content management system allows for rapid posting and modification along with a tested user interface in both English and Spanish. Before the release of each solution, the platform is used by testers and evaluators. Each solution includes a description, quotes, setup, and use, supplies, tips, photographs, and a downloadable PDF. Also included are links to supporting Worker Protection Standard information, educational materials, training tools, and relevant federal and regional regulation. This platform is now being used for other PNASH resources as well.

B.3. Competitive Revisions/Administrative Supplements

The Year 6 extension, 2021-2022, was supported through an administrative supplement to PNASH.

B.4. What opportunities for training and professional development did the project provide?

Developed a new PNASH e-learning course, Pesticide Learning Solutions, to demonstrate how to read a pesticide label, discuss pesticide exposure pathways and how to reduce exposure, share best practices for pesticide application, and provide pesticide safety resources from PNASH and regional and national sources.

Practical Solutions for Pesticide Safety PNASH Online On-Demand Courses, https://deohs.washington.edu/pnash/online-learning

Keeping Pesticide on the Farm: Practical Solutions for Minimizing Family Exposure, NASD Agricultural Training Series, https://training.nasdonline.org

B.5. How did you disseminate the results to communities of interest?
Dissemination through social media and presentations in conjunction with state pesticide recertification continuing education.

B.6 - What do you plan to do during the next reporting period to accomplish the goals?

Our promotion plan includes social media and meetings (remote and in-person). We are partnering with Oregon State University Pesticide Safety Education Program (PSEP) and the national Pesticide Educational Resources Collaborative (PERC). In addition, we will also be participating in agricultural health and safety events in Washington and Oregon to share solutions and resources.

C. PRODUCTS

C.1. Publications, conference papers, and presentations

None

C.2. Website(s) or other Internet site(s) – include URL(s)

https://deohs.washington.edu/pnash/handheld-psps

C.3. Technologies or techniques

NA

C.4. Inventions, patent applications, and/or licenses

NA

C.5. Other products and resource sharing

Training
Practical Solutions for Pesticide Safety PNASH Online On-Demand Courses | Pacific Northwest Agricultural Safety and Health Center, https://deohs.washington.edu/pnash/online-learning

Keeping Pesticide on the Farm: Practical Solutions for Minimizing Family Exposure, https://training.nasdonline.org

D. PARTICIPANTS

D.1. What individuals have worked on the project? Please include calendar, academic, and summer months.

Commons ID	S/K	Name	Degrees(s)	Role	Cal	Aca	Sum	Foreign	Country	SS
kitgalvin	x	Kit Galvin	MS, CIH	Project PI	13					
mitchong		Maria Tchong French	MS	Res. Scientist	12					
		Sarah Fish	BA	Graphic Designer	7					
		Pablo Palmandez	MS	Research Coordinator	7					
		Idanis Cruz		Research Coordinator	3					

D.2 Personnel updates

a. Level of Effort: NA

b. New Senior/Key Personnel: NA

c. Changes in Other Support: No changes for this period.

d. New Other Significant Contributors: NA

E. IMPACT

E.1 - What is the impact on the development of human resources, if applicable?

This education project identifies, evaluates, and adapts pesticide safety solutions that Northwest farmers developed for themselves. These practical solutions are then shared back to the industry through an online platform. This project focuses on handheld application equipment and builds upon our previous Practical Solutions for Pesticide Safety guide for broadcast spraying. This project is useful to nurseries, greenhouses, grass seed production, and reforestation industries.

E.2 - What is the impact the Public Health Relevance and Impact? The investigator should address how the findings of the project relate beyond the immediate study to improved practices, prevention or intervention techniques, legislation, policy, or use of technology in public health.

Handheld pesticide application takes place in farming and forestry work, and unintentional exposures can be common. Few evidence-based and practical solutions have been developed and shared across these industries.

This project builds on previous regional research, research translation, and practical solutions, and brings current relevant information to a broader national audience using new methods. With our partners in pesticide safety, we can increase the understanding and provide resources to further minimize pesticide handler exposure. This project offers solutions that 1) reduce exposure; 2) are practical, compatible, convenient, adaptable, safe, novel, and meet regulations; and 3) support the requirements and training needs of the revised US EPA Worker Protection Standard.

F. CHANGES

F.1 - Changes in approach and reasons for change, including changes that have a significant impact on expenditures

The COVID-19 pandemic slowed our ability conduct field implementation studies in a timely manner. Field studies instead shifted to an online format with a pad delivered to participants for a remote “walk through” evaluation with the project team.

F.2 - Actual or anticipated challenges or delays and actions or plans to resolve them

None.

F.3 - Significant changes to human subjects, vertebrate animals, biohazards, and/or select agents

No significant changes.

G. Special Reporting Requirements

G.1 Special Notice of Award Terms and Funding Opportunities Announcement Reporting Requirements
NA

G.2 Responsible Conduct of Research
NA

G.3 Mentor’s Research Report or Sponsor Comments
NA

G.4 Human Subjects

G.4.a Does the project involve human subjects?

Yes

G.4.b Inclusion Enrollment Data
See attached cumulate enrollment table

G.4.c ClinicalTrials.gov
NA

Does this project include one or more applicable clinical trials that must be registered in ClinicalTrials.gov under FDAAA?

G.5 Human Subject Education Requirement

Are there personnel on this project who are newly involved in the design or conduct of human subject's research?
No

G.6 Human Embryonic Stem Cells (HESCS)

Does this project involve human embryonic stem cells (only hESC lines listed as approved in the NIH Registry may be used in NIH funded research)?
No

G.7 Vertebrate Animals

Does this project involve vertebrate animals?
No

G.8 Project/Performance Sites

University of Washington, Seattle, WA

G.9 Foreign Component
NA

G.10 Estimated Unobligated Balance

G.10.a Is it anticipated that an estimated unobligated balance (including prior year carryover) will be greater than 25% of the current year's total approved budget?
No

G.11 Program Income

Is program income anticipated during the next budget period?
No

G.12 F&A Costs

Is there a change in performance sites that will affect F&A costs?
No

I. OUTCOMES

I. Provide a concise summary of the outcomes or findings of the award, written for the general public in clear and comprehensible language, without including any proprietary, confidential information or trade secrets

Note: project outcome information will be made public in NIH RePORTER

PRACTICAL SOLUTIONS FOR PESTICIDE SAFETY
https://deohs.washington.edu/pnash/practical_solutions

Challenge
Handheld pesticide application takes place in farming and forestry work, and unintentional exposures can be common. Few evidence-based and practical solutions have been developed and shared across these industries.

Project Overview
PNASH works with farmers, educators, and researchers across the Northwest to test and develop solutions originally developed by growers and workers for themselves. We have expanded from our original airblast application systems, to now include handheld and greenhouse applications. Each solution is assessed for the goals:
1) reduce exposure,
2) are practical, compatible, and convenient,
3) support the requirements and training for state regulations
and the revised US EPA Worker Protection Standard.

Findings to Date
- 50% interviewees have story of adoption/use in field.
- Reviewers found the online solutions visually appealing and accurate and the curated solutions useful.

Accomplishments
- 21 new solutions have been published in English and Spanish on our webpage. Each solution describes how pesticide exposure is reduced and share practices to reduce the exposure including a supply list, tips, photos, setup and use instructions, and links for more WPS information and relevant regulations.
- Developed a new remote approach to engage partners by providing a custom tablet used to gather pictures and conduct live walk-throughs and interviews.
- Completed adoption scenarios. For example, a participant adopted the room
- access protocol solution, motivated by the use of less pesticide products because they would only need to treat one room instead of several rooms.
- Developed a new PNASH e-learning course, Pesticide Learning Solutions, to demonstrate how to read a pesticide label, discuss pesticide exposure pathways and how to reduce exposure, share best practices for pesticide application, and provide pesticide safety resources from PNASH and regional and national sources.

Please reach out to pnash@uw.edu for assistance in sharing these solutions in your trainings.

Resources
https://deohs.washington.edu/pnash/practical_solutions

Practical Solutions for Pesticide Safety PNASH Online On-Demand Courses, https://deohs.washington.edu/pnash/online-learning

Keeping Pesticide on the Farm: Practical Solutions for Minimizing Family Exposure, NASD Agricultural Training Series, https://training.nasdonline.org

COMING SOON! Flash cards: Practical Solutions for Pesticide Safety

"I highly recommend this practical solution for greenhouses. All the mixing and loading can be done at the application site. Also, I am able to fit all the supplies and products in transport buckets."

- Oregon Greenhouse Worker

View Burden Statement

PHS Inclusion Enrollment Report

This report format should NOT be used for collecting data from study participants.

OMB Number: 0925-0001
Expiration Date: 3/31/2020

***Study Title (must be unique):** Galvin - Practical Solutions for Pesticide Safety

* Delayed Onset Study? ☐ Yes ☒ No

If study is not delayed onset, the following selections are required:

Enrollment Type ☐ Planned ☒ Cumulative (Actual)

Using an Existing Dataset or Resource ☐ Yes ☒ No

Enrollment Location ☒ Domestic ☐ Foreign

Clinical Trial ☐ Yes ☒ No **NIH-Defined Phase III Clinical Trial** ☐ Yes ☒ No

Comments: UW IRB #235

Racial Categories	Ethnic Categories									
	Not Hispanic or Latino			Hispanic or Latino			Unknown/Not Reported Ethnicity			**Total**
	Female	**Male**	**Unknown/ Not Reported**	**Female**	**Male**	**Unknown/ Not Reported**	**Female**	**Male**	**Unknown/ Not Reported**	
American Indian/ Alaska Native	0	0	0	0	0	0	0	0	0	0
Asian	0	0	0	0	0	0	0	0	0	0
Native Hawaiian or Other Pacific Islander	0	0	0	0	0	0	0	0	0	0
Black or African American	0	0	0	0	0	0	0	0	0	0
White	2	12	0	0	7	0	0	0	0	21
More than One Race	1	0	0	0	0	0	0	0	0	1
Unknown or Not Reported	0	0	0	0	0	0	0	0	0	0
Total	3	12	0	0	7	0	0	0	0	22

Report 1 of 1

< Previous Report **Delete Report** **Next Report >**

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